DEC STD 053-1 INTERFACE BETWEEN DATA CIRCUIT-TERMINATING EQUIPMENT AND THE PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) - WORLDWIDE

DOCUMENT IDENTIFIER: A-DS-EL00053-01-0 Rev A, 10-Feb-1989

ABSTRACT: This document defines the worldwide technical requirements of equipment connected to public switched network and leased telephone circuits. For U.S. and Canadian requirements, refer to *DEC STD 053-0 Interface Between Data Circuit-Terminating Equipment and the Public Switched Telephone Network (PSTN) in the U.S and Canada*.

APPLICABILITY: This requirements in this standard are mandatory for all data arrangements connected to PSTN for purposes of data or voice. This standard covers all products that are intended for direct connection to the telecommunications lines of a telecommunications administration outside of the U.S. and Canada and indirectly connected equipment up to the *barrier* required by this standard. Certain equipment for non-benign environments must also meet the additional requirements included under heading 1.

Refer to DEC STD 053-0 for the requirements for equipment to be installed in the U.S. or Canada.

STATUS: APPROVED 10-Feb-1989; see EL-INDEX-00 for expiration date.

This document is confidential and proprietary. It is an unpublished work protected under Federal copyright laws.

© Digital Equipment Corporation, 1989. All rights reserved.

DEC STD 053-1 INTERFACE BETWEEN DATA CIRCUIT-TERMINATING EQUIPMENT AND THE PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) - WORLDWIDE

DOCUMENT IDENTIFIER: A-DS-EL00053-01-0 Rev A, 10-Feb-1989

REVISION HISTORY: No previous revisions exist.

Document Management Category:	International Regulations (HRI)
Responsible Department:	Telecommunications, Modulations, and Transmission (TMT) Development
Responsible Person:	Jan Purwin
SMC Writer:	Sheri Smaller

APPROVAL: This document has been reviewed and recommended for approval for use throughout Digital by the general review group for its category.

Jan Purwin, Standard Owner

Eric Williams, Standards Process Manager

Direct requests for further information to:

Jan Purwin

TAY2-1/M5, DTN: 227-3336, LEVERS::PURWIN

Copies of this document can be ordered from:

Standards and Methods Control

NRO4/D4, DTN: 234-4423, JOKUR::SMC

Please provide your name, mailstop, cost center, badge number, and ENET address when ordering.

CONTENTS

1 SAFETY REQUIREMENTS FOR DIRECT CONNECTION OF APPARATUS TO TELECOMMUNICATION NETWORKS 1
1.1 OVERVIEW 1
1.2 DEFINITIONS RELATED TO SAFETY 2
1.3 GENERAL REQUIREMENTS 6
1.3.1 Limits of Voltage Transmitted to the Communications Line 6
1.3.2 Design Factors for Protection Barriers 7
1.3.3 Power Mains Supply 7
1.3.4 Severe Operating Conditions and Power Surges 7
1.4 TECHNIQUES REQUIRED FOR THE ISOLATION OF EXCESSIVE VOLTAGES . 7
1.4.1 Provision of Protection Barriers 8
1.4.2 Protection of the Network 9
1.4.3 Protection of the Apparatus User 10
1.4.3.1 PC Board Creepage and Clearance 11
1.4.4 Interface Connections 11
1.4.5 Requirements for Attachments with Ports for Connection of Other Apparatus . . 11
1.4.6 Heating of Apparatus by Communications Line Conditions 12
1.5 SIGNALING AND TRANSMISSION EARTH GROUND 12
1.6 PROTECTION BARRIERS AND INSULATION SYSTEMS 12
1.6.1 General 12
1.6.2 Creepage Distances and Clearances 12
1.6.3 Communications Line Protection Barriers 13
1.6.3.1 Equipment that Requires Excess Voltage (250 V) 13
1.6.3.2 Excessive Voltage Greater than Barrier Voltage 13
1.6.4 Signal Transformers and Relays Used as Protection Barriers 14
1.6.5 Isolating Relays 15
1.6.5.1 Double Insulation 15
1.6.5.2 Earth Protection 16
1.6.6 Capacitors as Protection Barriers 16
1.6.7 Opto-Electrical Devices 16
1.6.8 Isolation Between Wiring and Terminations 16
1.6.9 Detailed Requirements for All Equipment 17
1.6.10 Detailed Requirements for Double-Insulated, Mains-Powered Equipment 17
1.6.11 Isolation of the Telecom Line from the External Metal of Equipment 18
1.6.12 Connection of Dc Voltages from Equipment 19
1.6.13 Acoustic Coupling 20
1.6.14 Other Devices, Techniques, and Construction Methods 20
1.6.15 Information to be Supplied by Digital 21
1.6.15.1 Information Required for Testing Purposes 21
1.6.15.2 Instructions for Use 21

2 QUALITIES RELATED TO DC VOLTAGE 22

2.1 POLARITY 22
2.1.1 Insulation Resistance 23
2.1.2 Loop Resistance 23
2.1.3 Transient Response of the Loop Current 25
2.1.3.1 Dialing with Loop Pulsing 25
2.1.3.2 Dial Pulse Requirements 26
2.1.4 Series Resistance 26
2.1.5 Electric Load 27

3 QUALITIES RELATED TO RINGING SIGNAL FREQUENCIES 27
3.1 RINGING SOURCE DESCRIPTION 27
3.2 RINGING DETECTION 28
3.3 INPUT IMPEDANCE 28
3.4 IMPEDANCE TOWARDS EARTH 28
3.5 ELECTRIC LOAD 29
3.6 INSERTION LOSS 29

4 QUALITIES RELATED TO VOICE FREQUENCIES 29
4.1 INPUT IMPEDANCE 29
4.1.1 Return Loss 29
4.2 IMPEDANCE BALANCE TO EARTH 31
4.3 INSERTION LOSS 33
4.4 TRANSMISSION LEVELS 33
4.4.1 Transmission of Voice 34
4.4.2 Transmission of Data 34

5 EQUIPMENT WITH CALLING FUNCTION 35
5.1 GENERAL 35
5.2 DIAL TONE RECEPTION 35
5.3 DIALING 36
5.3.1 Dialing Procedure 36
5.3.2 Dialing with Loop Pulsing 37
5.3.2.1 Spark Quenching Circuit 37
5.3.2.2 Pulse Digit Designation 38
5.3.2.3 Mechanical Devices 39
5.3.2.4 Electronic Devices 39
5.4 DIALING WITH DTMF PULSES 40
5.5 SWITCHING OF TRANSMISSION EQUIPMENT 41
5.6 DURATION OF LOOP CONDITION 41
5.7 REPETITION OF A CALL 41
5.8 IDENTIFICATION SIGNAL 42
5.8.1 Calling Tone 42
5.8.2 Answering Tone 42

6 EQUIPMENT WITH ANSWERING FUNCTION 42
6.1 GENERAL 42
6.2 RINGING SIGNAL RECEPTION 43
6.3 SWITCHING-IN OF TRANSMISSION EQUIPMENT 44
6.4 IDENTIFICATION SIGNAL 44

6.5 DURATION OF LOOP CONDITION 44
7 EXAMPLE OF PSTN INTERFACE 45
8 EXAMPLE OF LEASE LINE INTERFACE 45
9 AUTODIAL REQUIREMENTS BY COUNTRY 46
9.1 AUSTRIA 46
9.2 BELGIUM 46
9.3 DENMARK 46
9.4 FINLAND 47
9.5 FRANCE 47
9.6 GERMANY 48
9.7 IRELAND 48
9.8 ITALY 48
9.9 JAPAN 48
9.10 NETHERLANDS 48
9.11 NORWAY 49
9.12 SWEDEN 49
9.13 SWITZERLAND 50
9.14 UNITED KINGDOM 50
10 COUNTRY-SPECIFIC INFORMATION AND VARIANCES 51
10.1 AUSTRALIA 51
10.2 AUSTRIA 51
10.3 BELGIUM 51
10.4 DENMARK 51
10.5 FINLAND 51
10.6 FRANCE 53
10.7 GERMANY 53
10.8 HOLLAND 53
10.8.1 Tone Detector 54
10.8.2 Spark Quenching Circuit 54
10.8.2.1 Transmission Level of DTMF Tones 55
10.8.2.2 Automatic Re-dialing 55
10.8.2.3 Connection 56
10.9 IRELAND 56
10.10 ITALY 56
10.11 NORWAY 56
10.12 SWEDEN 56
10.13 SWITZERLAND 56
10.14 HONG KONG 56
10.15 JAPAN 57

10.16 UNITED KINGDOM 57
10.16.1 General 57
10.16.2 Physical Network Connection Methods 58
10.16.3 Electrical Characteristics of the Network 58
10.16.3.1 Exchange Line Voltage 58
10.16.3.2 Exclusive Lines 58
10.16.3.3 Positive Battery 58
10.16.3.4 Voltage Transients 58
10.16.3.5 Standard Supervisory Tones 59
10.16.3.6 Call Arrival Indication (Ringing) 60
10.16.3.7 Howler 61
10.16.3.8 Verbal Announcements (VA) 61
10.16.3.9 Meter Pulses 62
10.16.3.10 Noise, Induced Voltages and Line Surges 62
10.16.3.11 Distribution of Insertion Loss 62
10.16.3.12 Distribution of Relative Group Delay 62
10.16.3.13 Routing Digits 62
10.16.3.14 Ring Trip 63
10.16.4 Ringer Equivalence Number and Ringing Detector Characteristics 63
10.16.4.1 Determination of REN 63
10.16.4.1.1 63
10.16.4.1.2 63
10.16.4.1.3 64

11 LABELING REQUIREMENTS 64

12 CABLES AND ADAPTERS REQUIRED TO CONNECT TO PSTN 64

Appendix A SURGE TESTING 65

A.1 SURGE TESTING 65

A.2 HEATING OF COMPONENTS 66

Appendix B RELATED DOCUMENTS 69

B.1 AUSTRIA NATIONAL REQUIREMENTS 69
B.1.1 General Information 69
B.1.2 National Regulations 69
B.1.3 Telex and Data Terminal Equipment 69
B.1.4 PSTN Terminals and Additional Equipment 70
B.1.5 Technical Requirements for High Frequency Equipment 70
B.1.6 Data Transmission and Telecontrol 71
B.1.7 Addresses to Obtain National Standards 71

B.2 BELGIUM NATIONAL REQUIREMENTS 71
B.2.1 General Requirements 71
B.2.2 Technical Requirements 71
B.2.3 Addresses to Obtain National Standards 72

B.3 DENMARK NATIONAL REQUIREMENTS 73
B.3.1 Requirements for Connection to Leased Lines 73
B.3.2 Requirements for Connection to PSTN 73
B.4 FINLAND NATIONAL REQUIREMENTS 73
B.5 FRANCE NATIONAL REQUIREMENTS 74
B.5.1 Addresses to Obtain National Standards 75
B.6 FEDERAL REPUBLIC OF GERMANY NATIONAL REQUIREMENTS 75
B.6.1 National Telecom Requirements - DTEs 75
B.6.2 Complementary and Additional Terminal Equipment of the PSTN 77
B.7 HONG KONG NATIONAL REQUIREMENTS 77
B.8 ITALY NATIONAL REQUIREMENTS 78
B.8.1 Comitato Electtrotecnico Italiano (CEI) Standards 78
B.8.2 PTT Technical Standards 78
B.8.3 SIP Technical Specifications (Complementary to and in Conformance with the PTT Standards) Applying to Terminal Equipments Purchased by SIP 79
B.9 JAPAN NATIONAL REGULATIONS 79
B.10 NETHERLANDS NATIONAL REQUIREMENTS 79
B.10.1 Addresses to Obtain National Standards 80
B.10.2 Netherlands Postal and Telecommunications Services (PTT) 80
B.11 NORWAY NATIONAL REQUIREMENTS 81
B.11.1 Specifications for Subscriber Equipment 81
B.11.2 Addresses to Obtain National Standards 82
B.12 SPAIN NATIONAL REQUIREMENTS 83
B.13 SWEDEN NATIONAL REQUIREMENTS 83
B.13.1 General Information 83
B.13.2 Electrical Safety 83
B.13.3 Connection to the Telephone Network and Leased Lines - General 83
B.13.4 Transmission of Voice 83
B.13.5 Additional Equipment 83
B.13.6 Transmission of Data, Text, and Image 83
B.13.6.1 Datex and Telepak 83
B.13.6.2 Telegraphy, Telex, Teletex, and Facsimile 84
B.13.6.3 Datel (Data Transmission via the Switched Telephone Network: Connection to the Administration's Modem) 84
B.13.7 Sweden PTT Standards 84
B.13.8 Addresses to Obtain National Standards 84
B.14 SWITZERLAND NATIONAL REQUIREMENTS 84
B.14.1 General 84
B.14.2 Telephone 85
B.14.3 Telematic 85
B.14.4 Addresses to Obtain National Standards 85

B.15 UNITED KINGDOM NATIONAL REQUIREMENTS 85
B.15.1 BABT Special Investigation Test Schedules (SITS) 87
B.15.2 DTI Approval Scheme Specifications 88
B.15.3 Addresses to Obtain National Standards 88

Appendix C REFERENCED DOCUMENTS 89

C.1 EL-Class Digital Documents 89

FIGURES

1 Example of a Power Supply Arrangement 4
2 Example of Protection with PBX 4
3 Protection Within a Modem 5
4 Protection Within DTE 5
5 Protection Within a Box Between the DTE and Modem 5
6 Voltage Limits at NTTP Port 15
7 Possible Method of Protection Against High Voltage, Low Current Sources (Typical) 19
8 Test Circuit for Testing Insulation Resistance 23
9 Measuring Setup 24
10 Loop Resistance Limits 25
11 Series Resistance Measurement Circuit 27
12 Return Loss Measurement - PSTN Setup 30
13 Return Loss Measurement - Lease Line Setup 30
14 Representative Return Loss Plot 31
15 Impedance Balance Measurement 32
16 Sequence of Dialing Operations 37
17 Dc Characteristics Impulse Dialing State 39
18 Ringing Signal Reception Test Setup 43
19 Telephone Line Basic Configuration 45
20 Interface for Attaching to 4-Wire Lease Lines 46
21 Test Wave Form 66

TABLES

1 Acoustic Coupler Separation Distances 20
2 Telephone Exchange Parameters 22
3 Dial Pulse Requirements 26
4 Ringing Sources 27
5 Ac Requirements for Line Interface 32
6 Transmit Levels 34
7 Dialing Methods 38
8 Dial Pulse 38
9 DTMF Tones 40
10 Important Tones in the Dutch Telephone Network 53
11 Important Tones in the UK Telephone Network 59
12 Call Arrival Indication (Ringing) 60

13 Howler 61

INTRODUCTION

This standard establishes technical requirements for interfacing and connecting equipment to the Public Switched Telephone Network (PSTN) for purposes of data transmission. The requirements for connection to leased lines are also addressed. Compliance with these requirements is intended to ensure minimum acceptable compatibility with the PSTN.

It is the designers' responsibility to strictly adhere to the specifications to obtain approvals.

In this standard, mandatory performance criteria are designated by the word *shall* and advisory criteria are designated by the word *desirable*. In some cases, implementation within the data arrangement of strapable options may be required to meet certain location-oriented operating requirements. To ensure satisfactory performance, the following two items are needed.

- Equipment design, hardware, and firmware/software in compliance with this standard
- A process for configuring the data arrangement to the requirements of its telephone network

This standard is similar to DEC STD 053-0. Some requirements may appear to be the same to the casual observer. The differences, which are sometimes slight and sometimes conflicting, preclude designing an interface that will simultaneously satisfy the requirements of DEC STD 053-0 and this standard.

1 SAFETY REQUIREMENTS FOR DIRECT CONNECTION OF APPARATUS TO TELECOMMUNICATION NETWORKS

1.1 OVERVIEW

These safety requirements are intended to ensure that apparatus connected to a telecommunication network does not adversely affect the network or interfere with the service available to other users. To safeguard personnel operating or maintaining the telecommunications network and users of apparatus connected to the network, it is essential to prevent the transmission of excessive voltages from connected equipment to the telecommunications line and from the telecommunications line to the connected equipment. The safety of personnel operating or maintaining the network and of users of the apparatus from hazards arising from the network must be ensured.

This standard applies to apparatus suitable for normal indoor environments, such as computer rooms, offices, and homes. Refer to *DEC STD 102-0 Environmental Standard for Computers and Peripherals - General Test Requirements* for a description of these environments.

Additional requirements generally apply to apparatus suitable for more severe environments, such as outdoor applications, medical applications, or applications in industrial or hazardous environments.

Examples of environments in which equipment must meet requirements, in addition to those specified in this standard, follow.

- Equipment operated from or containing voltages exceeding 1000 volts
- Equipment located in particularly hazardous locations, such as mines, explosive, and other dangerous areas

- Equipment located at sites, such as power stations, where the apparent earth ground potential may rise thousands of volts above the earth ground potential at the other end of a telecommunications circuit

This standard addresses only the requirements for the applications that Digital currently addresses or is likely to address in the foreseeable future. It does not address the requirements for other applications not presently foreseen, for example: equipment that sends ringing voltages into the telecommunications line. There are requirements for these applications not included in this standard.

This subhead describes the safety requirements between the safety extra low voltage (SELV) portion of the apparatus, including operator access areas, and the communications line. Refer to *DEC STD 119-0 Digital Product Safety - Introduction and General Requirements* for the requirements between the ac line and other hazardous voltages, and the SELV portion and the communications line.

1.2 DEFINITIONS RELATED TO SAFETY

Accessory port - A port declared by the supplier solely for the connection of accessories that do not generate voltages in excess of SELV. Examples of accessories are microphones, ear pieces, loudspeakers, and foot control switches.

Administration - The company, authority, or agency supplying the telecommunication line or service to which the Digital-supplied equipment is to be connected.

Barrier voltage - The maximum dc, rms ac, or peak ac value of the excessive voltage that a particular protection barrier is designed to stop.

Communications line - The line, circuit, or facility provided by the administration that connects to the communications line interface.

Communications line interface - A connection point located on the subscriber's premises where the subscriber's apparatus can be connected to the line or equipment supplied by the administration. Tests can be carried out, with or without disconnection of the subscriber's apparatus, to assist in the isolation of faults. For example, where the administration supplies the modem, the RS-232-D/CCITT V.24/V.28 interface is the communications line interface.

The communications line interface marks the limit of the telecommunication authority's responsibility for the provision, installation, and maintenance of facilities.

NOTE

On apparatus suitable for connection to the communications line only via other apparatus, the communications line interface is the port for connection to that other apparatus. Where the indirectly connected apparatus is a separate power supply unit, its communications line interface is the power outlet to the other apparatus.

This standard is written so it can be applied to individual units of apparatus when designed, and later when submitted for approval, without necessarily knowing all details of the subscriber's other apparatus to which it will later be connected. Although the functions of the adjacent apparatus may be well defined, the manner of complying with this standard need not be.

Connection port - A facility of the apparatus for connection to other apparatus or to the communication line.

Dangerous voltage - (excessive voltage) For the purposes of this standard, any voltage is considered to be dangerous if it is one or more of the following:

- A continuous ac voltage between 10 and 200 Hz that is in excess of 42.5 V (peak).
- A continuous dc voltage that, when added to the dc voltage likely to be found in the associated telecommunications plant or its electrical environment, results in a sum that is in excess of 120 V. To ensure that this 120 V limit is maintained, any one voltage of the sum of potentially additive voltages in the equipment shall not exceed the following.
  - — In equipment that has dc voltages decoupled from actual connection to a telecommunications line by other circuitry or components: 70 V when measured between two conductors, or positive 70 V or negative 120 V on one conductor relative to earth ground. It is not permissible to have both positive 70 V and negative 120 V relative to earth ground on different conductors within the same item or equipment.
  - — In equipment that has dc voltages directly connected to a telecommunications line: 60 V when measured between any two conductors that are not related to earth ground, or between one conductor and earth ground. It is permissible to have both 60 V positive and 60 V negative relative to earth ground on different conductors within the same item of equipment.
- An ON period of not more than 1 second with an intervening OFF period of not less than 2 seconds. Or
  - — A frequency outside of the range 10 to 200 Hz.
  - — A wave form, the characteristics of which merit consideration as a special case, for example, telegraph-type signals and switching mode pulses in data systems.
- A voltage where the combination of dc and ac components of any frequency is such that the value of the expression:

  $$Udc + 3\ Uac \leq 150\ V$$

  Where, Udc is the value of the dc component voltage and Uac is the rms value of the ac component voltage.

NOTE

This includes the limiting values of 150 V dc only and 50 V ac rms only.

- A ringing signal of frequency between 12 and 55 Hz, including any dc component, not exceeding 150 V ac rms with respect to earth ground.
- A telegraph signal of any frequency, not exceeding 96 V peak with respect to earth ground.

NOTE

Generally, data equipment in accordance with IEC 435 is acceptable to Telecom Australia. The safety extra-low voltage limit of 42.4 V ac (peak) of IEC 435 is acceptable for data equipment in lieu of the normal 30 V ac (peak) limit of TA 1302 if the data equipment is designed to generally comply with IEC 435. This is not valid in the UK, where above and beyond IEC 380, it is required to pass BSI 6301 standard.

Excessive voltage - Refer to the definition for dangerous voltage.

Extra-low voltage - Voltage not exceeding 42.4 V ac (peak) or 50 V dc.

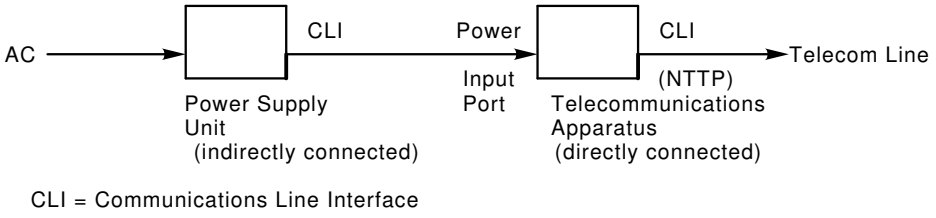
Network Termination and Test Point (NTTP) - The demarcation reference point between the equipment and the public network. In terms of BS 6301, it applies to both direct and indirect connected interfaces.

In this standard, the NTTP is a direct connection to the PSTN circuits.

Power supply configurations and approval - A separate power supply unit supplying power to telecommunication apparatus is considered to be a piece of subscriber's apparatus, indirectly connected to the telecommunications network. For this purpose, a power supply unit would normally be a source of extra-low voltage (dc or ac), but could also be a central source of, for example, a ringing signal (70 to 100 V ac). In the terminology of this standard, the power is fed from a power output port on the power supply unit, which is its communications line interface, to a power input port on the telecommunications apparatus. Whether or not the power supply unit needs to comply with this standard depends, as with any indirectly connected apparatus, on whether the power input port on the telecommunications apparatus to which it is connected is a labeled port or not.

An example of such an arrangement is shown in Figure 1.

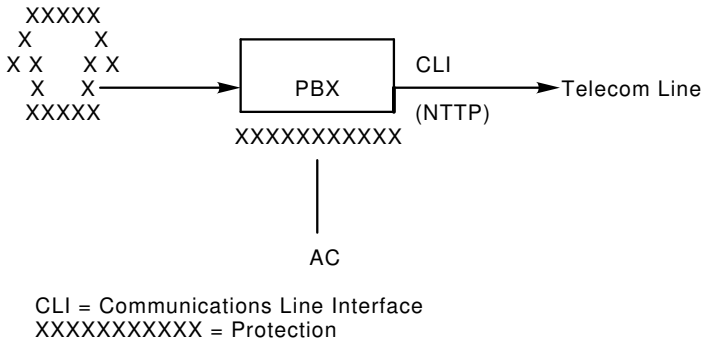
Figure 1: Example of a Power Supply Arrangement



A telecommunications apparatus that needs a separate power supply unit may be approved.

Protected circuit - A part of the apparatus isolated from excessive voltages. Examples of location of protection are shown in Figure 2, 3, 4, and 5.

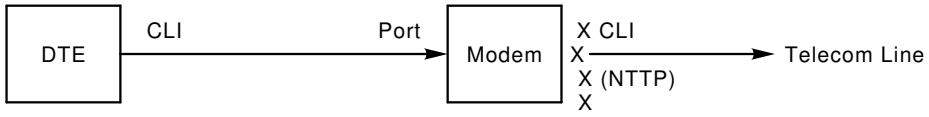
Figure 2: Example of Protection with PBX



For example, in a directly connected modem with an indirectly connected data terminating equipment (DTE), objectives could be achieved, as far as the DTE is concerned, by:

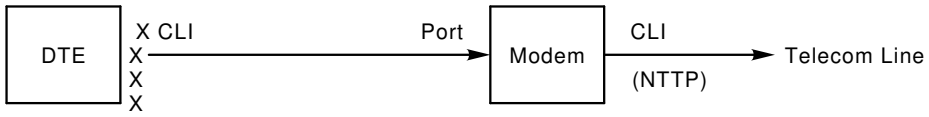
- Protection within the modem, which provides the simplest solution in most cases. Refer to Figure 3.
- Protection with the DTE. Refer to Figure 4.
- Protection within a box between the DTE and the modem. Refer to Figure 5.

Figure 3: Protection Within a Modem



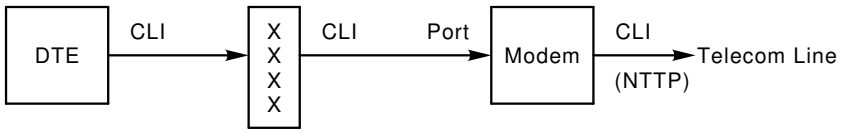
XXXXX = Protection
CLI = Communications Line Interface

Figure 4: Protection Within DTE



XXXXX = Protection
CLI = Communications Line Interface

Figure 5: Protection Within a Box Between the DTE and Modem



XXXXX = Protection
CLI = Communications Line Interface

Protection barrier - One or more identifiable components providing isolation from excessive voltages.

Safety earth ground - A connection to earth ground provided for safety purposes. Refer to *DEC STD 002-0 Ac Power Wiring, Safety Earth Grounding, Plugs and Receptacle Information and Requirements* and DEC STD 119-0.

Safety Extra Low Voltage (SELV) circuit - A circuit designed and protected so that under normal and single fault conditions the voltage between any two circuit parts accessible to users (one of which may be the body of the apparatus or earth ground) does not exceed a safe value. Refer to DEC STD 119-0.

Telecommunications line - A circuit provided by a local telecommunications administration to a distance point or to a switching machine (circuit switch or message switch).

Unprotected circuit - A part of the apparatus not isolated from excessive voltages.

User-accessible part - A part of the apparatus that may be touched by the test finger and to which access may be gained without the use of a tool or for which the means of access is deliberately provided to the user. Refer to DEC STD 119-0.

- Apparatus accessible only to service personnel, for example, a PBX installation in a normally locked room or similar environment, so that user access is prevented, is not regarded as user-accessible (BS 6301 clause 2.3.9; as amended by AMD 4520). Such apparatus must have installation instructions requiring its installation in such a location.
- For equipment powered from the power mains that can be unplugged from the power mains by the user, the pins of the power mains plug shall be regarded as user-accessible parts.

1.3 GENERAL REQUIREMENTS

All equipment shall meet the other requirements of this subhead of this standard at ambient temperatures from 0 to 50 degrees C and under supply variations of +10% and -15% from nominal.

All equipment shall be adequate to ensure that with normal handling and use for its designed application, it will not develop any faults rendering it unsafe.

1.3.1 Limits of Voltage Transmitted to the Communications Line

The apparatus shall not transmit an excessive voltage to the communications line, between any two conductors, or between any conductor and earth ground.

Passive and low voltage apparatus do not require protection barriers, except to protect users from the telecommunications line itself. The following are power requirements for passive and low voltage apparatus.

- Equipment powered by batteries of less than 150 V dc that do not generate an excessive voltage internally and are not recharged from a source of excessive voltage, such as the power mains supply. Where a charger is used, it must meet the requirements of this standard and DEC STD 119-0.
- Equipment, such as passive filters or transducers, requiring no operating power.
- Equipment deriving its power from the telecommunication line. Such equipment must meet the power limitations imposed by each administration where it is approved.
- Equipment powered by a voltage transmitted over a leased line that does not internally generate an excessive voltage. The far end power feeding equipment must be approved for connection to the administration's facilities to ensure that the voltage it transmits to the leased line is not an excessive voltage.

1.3.2 Design Factors for Protection Barriers

The following guidelines should be taken into account in the design of protection barriers. They are not to be taken as design criteria or requirements.

- The design should minimize the chance of construction defects creating a hazard.
- Materials and construction should be such that, as far as can be reasonably foreseen, and taking likely operating conditions into account, the protection barrier will continue to meet the requirements of this standard for twice the estimated lifetime of the apparatus.
- Components should operate within the ratings supplied by the component manufacturer.
- Where reliance is placed for safety on parameters that are not specified by the component manufacturer, the apparatus manufacturer should carry out a test to ensure adequate safety and reliability.

1.3.3 Power Mains Supply

The power mains supply, if present, must meet the requirements of DEC STD 002-0, DEC STD 119 (all sections), and *DEC STD 122-0 Ac Power Line Standard: Design Requirements and Guidelines*. The equipment shall have IEC 380 and/or IEC 435 certification prior to any submittals to the PTTs. For submittal to BABT, the equipment must be BS 6301 and must be certified by BABT as such. The UL and CSA certification is not mandatory, since such telecommunications equipment does not meet FCC part 68 and DOC requirements for telecommunication and, therefore, cannot be sold in the U.S. and Canada.

1.3.4 Severe Operating Conditions and Power Surges

Voltages caused by lightning or other extraneous sources may occur at the communications line interface. These voltages may be unidirectional or alternating and of a transient nature. Transient and prolonged voltages are also present on many circuits as normal functional characteristics. They may reach a peak value of the order of several hundred volts.

Prolonged voltages of at least 100 volts peak may be encountered, for example, ringing current.

Equipment containing semiconductors is particularly vulnerable to damage by comparatively small excess voltages, even of a short duration.

Generally, the administrations accept no responsibility for damaged equipment caused by any of these conditions.

The user will generally expect equipment to withstand all but the most severe conditions induced by lightning or similar occurrences without permanent damage. This is true even though it is not required by the various administrations. Thus, Digital-provided equipment should withstand most lightning-induced surges on either the communications line or the power line.

1.4 TECHNIQUES REQUIRED FOR THE ISOLATION OF EXCESSIVE VOLTAGES

1.4.1 Provision of Protection Barriers

The apparatus shall be one of the following:

- Connected to safety earth ground via the power supply cord
- Double insulated
- All insulated

The principle of using two separate lines of defense against the possibility of any contact between an excessive voltage in the equipment and the telecommunications plant shall be employed. However, reinforced insulation, which provides a single line of defense of highest integrity, affording protection equivalent to that provided by two independent lines of defense, may be used.

The first line of defense shall generally be functional (basic) insulation.

The minimum level of functional insulation provided shall be 250 V grade functional insulation of a recognized standard that specifies other values; IEC 435 is given as an example, which specifies functional insulation graded in accordance with working voltages lower than 250 V ac rms.

The second line of defense shall generally be provided by the use of one, and if necessary, both of the following methods.

- Physically interposing between all components connected to the telecommunications plant and the functional insulation described herein either:
  - — Protective (supplementary) insulation, thereby raising the electrical isolation to the standard of double insulation, or
  - — A conductive screen or circuitry, which is connected to earth ground, in accordance with the following paragraphs.

    The connection to circuitry earth ground for safety is described in IEC 435 for SELV secondary windings of transformers. Equipment using this method is called *earth-protected*.

    A high-integrity mains earth (safety earth ground) connection shall be:

    - Hard-wired to the equipment by a licensed electrician. This is only applicable to equipment in a fixed location, or
    - Connected by means of a flexible cord that has been:

      Terminated directly via a terminal box on to the protective earth building wiring by a licensed electrician, and

      Connected to the equipment so that its removal and replacement can only be effected with the aid of special tools, which are normally available only to the equipment manufacturer or his agent.
  - — For data equipment only, an ad hoc, high-integrity earth that can be inspected and verified by a telecommunications service person, in combination with double insulation of the modem line interface.

The cord shall have an adhesive label attached within two mm of the 3-pin plug with the supplier's logo and the following warning:

FOR YOUR SAFETY

- Insert this plug only into effectively earthed 3-pin, plug-socket outlet.
- If any doubt exists regarding the earthing of the plug-socket outlet, consult a qualified electrician.
- Extension cords must not be used.
- Do not cut off or replace this plug or cord. If it is damaged or defective, contact the equipment supplier.

The wiring to the power socket shall be provided or tested by a licensed electrician, and evidence of this shall be available to Telecom Australia when the associated data equipment is installed or maintained. Particular attention shall be paid to the earthing conductor.

- Electrical circuitry to limit the excessive voltage and reduce it to a safe level. The use of limiting circuitry is required where it is physically impractical to interpose either protective insulation or an earthed screen.

  The techniques of double insulation and earth protection are equally acceptable. Double insulation relies primarily on intrinsically safe equipment design, whereas earth protection relies on equipment design, installation, and maintenance practices.

  The level of isolation achieved shall be maintained across all possible paths by which a excessive voltage could enter the telecommunications plant.

  NOTE

  If double insulation is provided, Telecom Australia is not satisfied by the square within a square, which is generally acceptable in Australia. Refer to (*DEC STD 178-5 Marking Symbology*). It insists on the following wording:

  DO NOT EARTH TO MAINS EARTH. DOUBLE INSULATED

  Double insulation shall also be provided if only a mains earth of limited integrity is provided.

One or more of the isolation methods indicated in subhead 1.4 must be used to protect the administration's plant and equipment from each excessive voltage source connected to or generated in the equipment.

1.4.2 Protection of the Network

Where the apparatus uses or internally generates an excessive voltage, there shall be one or more protective barriers meeting the requirements of subhead 1.4.1 between the communications line interface and each circuit at an excessive voltage.

Where the normal operating voltage of the unprotected circuit at a protection barrier is an excessive voltage, the protection barrier shall be designed to provide reinforced insulation; otherwise, it shall be designed to provide supplementary insulation, whose working voltage shall be taken as the voltage that would exist across it if the relevant basic insulation were short-circuited.

The barrier voltage shall not be less than the excessive voltage. Compliance is checked by inspection of creepage and clearance distances.

NOTE

Relevant requirements for creepage distances and clearances are specified in subhead 1.4.3.1.

For design purposes, it may be assumed that the communications line is the source of 150 V dc.

Where the design of a protection barrier protecting the communications line relies on a safety earth ground connection for its integrity:

- The internal connection of the safety earth ground shall meet the requirements of DEC STD 002-0 for a safety earth ground connection.
- The safety earth ground connection shall not be made through a plug and socket unless the hazards are removed when the connection is broken. If a safety earth ground connection is required for two or more items of equipment, it must not be possible to remove the safety earth ground connection while any one item of equipment remains connected to the ac power mains.
- Where the ac power mains are supplied directly from a fused distribution point (hardwired), the apparatus must be connected to safety earth ground by a direct connection.
- To ensure an efficient path within the equipment, discrete wiring should be used to connect the barrier device to the safety earth ground input. Alternatively, a safety earth ground path via one solid piece of metalwork is acceptable, but other bolted or screwed connections via the chassis are not permitted.

Compliance is checked by the appropriate tests in DEC STD 119-0.

1.4.3 Protection of the Apparatus User

There shall be adequate isolation between the communications line interface and user-accessible parts in the apparatus.

This isolation shall be provided by any of the following:

a. Insulation between the communications line interface and the user-accessible parts, or

b. A combination of insulation and voltage-limiting components

c. Connecting the user-accessible parts to safety earth ground; within the apparatus, such internal connections to safety earth ground

Item a is strongly preferred by Digital.

The required insulation is 3750 V rms between the communications line and user-accessible parts and SELV circuits.

NOTE

The insulation specified in item a may be within a protection barrier, for example, a signal transformer or a relay.

After the test, the insulation resistance shall not be less than 100 megohm measured with 500 V dc source.

1.4.3.1 PC Board Creepage and Clearance

Creepage distances and clearances shall be 0.200 inch or 5 mm minimum between protected and unprotected circuits. These distances shall be maintained at the closest approach, for example, between the extremes of printed-wiring pads on a printed-circuit board. These distances are required between conductors on an inner layer of a printed-circuit board, but need not be maintained between layers if the layer material after processing will meet the voltage breakdown test. If an intervening conductive material is floating, the distance from the unprotected circuit to the floating material, for example, auto thiefing, plus the distance from the floating material to the protected circuit must meet the requirements. Conformable coating shall be ignored in checking clearances and creepage distances. Refer to *DEC STD 030-0 Module Manufacturing Standard - Introduction and General Information* for printed-wiring board layout requirements.

Compliance shall be checked by inspection and by conditioning as described.

After the test, the insulation resistance shall not be less than 100 megohms measured at 500 V dc between the communications line and earth ground or any accessible part.

1.4.4 Interface Connections

The preferred connector at the equipment end is the U.S. FCC part 68 8-pin socket, which will accommodate 6-pin (or 4-pin in 6-pin frame) or 8-pin plugs. The required connector at the telecommunications line end is the plug (or wire lead configuration) required by the local telecommunications administration where the equipment is installed.

There is a particular plug and socket arrangement for each country in which we sell.

For appropriate adapter cables, refer to EL-EN210-00, *Technical Bulletin Telephone Adapter Cables*.

1.4.5 Requirements for Attachments with Ports for Connection of Other Apparatus

For a port that is not a telecommunications line interface and not an accessory port, either:

a. The port shall be marked in all languages of the countries where it might be used. It is strongly recommended that this marking not be used for manufacturing and distribution for logistical reasons, or

b. There shall be one or more protection barriers between the port and the communications line interface, and

There shall be adequate isolation between the communications line interface and the port, and

The port shall be incompatible with the plug specified in BS 6312: 1982 (the British *modular plug*) or any other plug likely to be used for connection to the communications line in any country where the apparatus might be used.

Compliance with the requirements of item a or paragraph three of item b, where appropriate, is checked by inspection.

The electrical pin terminals of an accessory port, whether or not they are user-accessible, shall meet the requirements of this subhead as if they were user-accessible parts. An accessory port shall not be compatible with a plug for connection to any other port of the apparatus. Compliance is checked by inspection.

1.4.6 Heating of Apparatus by Communications Line Conditions

A part of the apparatus that transmits or receives signal voltages directly to or from the communications line shall not overheat under normal operating conditions.

The temperature rise of any user-accessible parts shall not exceed the appropriate limit given in DEC STD 119 (all sections).

1.5 SIGNALING AND TRANSMISSION EARTH GROUND

No equipment presently sold, or anticipated to be sold by Digital, uses a signaling or transmission earth ground.

If an item of equipment applies an earth ground condition to the telecommunications line or to equipment or conductors not isolated from the telecommunications line or plant, the following conditions must be met.

- Where practical, a safety earth ground should not be used for this purpose and a separate earth ground should be provided. Where this is not practical, Digital must show how adequate checks will be carried out to test the integrity of the safety earth ground at the user's premises.
- The signaling and transmission earth ground connection to the equipment should be made by an insulated wire of a cross-sectional area not less than 1.5 square millimeters (AWG 14), taken directly from an earth terminal provided by the customer.
- The point of connection of any signaling and transmission earth ground must be clearly marked.

1.6 PROTECTION BARRIERS AND INSULATION SYSTEMS

1.6.1 General

The protection barrier shall not be bypassed by components or wiring unless those components and wiring meet the isolation requirements specified herein as appropriate. Compliance is checked by inspection.

NOTE

A protection barrier prevents an excessive voltage that may reasonably be expected to arise in the unprotected circuit from reaching the protected circuit.

Protection barriers may be employed anywhere within an apparatus and they are not restricted to input and output circuitry.

Any number of protection barriers may be used to provide protection from any number of excessive voltages. A protection barrier may provide protection for two or more purposes.

1.6.2 Creepage Distances and Clearances

Creepage distances and clearances, as well as distances through insulation, shall comply with items a through e as follows.

a. For protection barriers protecting the telecommunications network in accordance with subhead 1.4.1, except as specified in subhead 1.5, creepage distances and clearances shall comply with subhead 1.6.2. Compliance is checked by inspection.

b. For protection barriers or insulation systems protecting the user in accordance with subhead 1.4.3 or subhead 1.4.3.1 item b.2, creepage distances shall not be less than 5 mm and clearances shall not be less than 5 mm, except there shall be no minimum insulation distance on coated parts of coated printed-circuit boards. Compliance is checked by inspection.

c. For protection barriers protecting the telecommunications network, creepage distances and clearances shall not be less than 5 mm.

d. Distances through insulation shall not be less than 0.4 mm; although, no minimum distance shall apply to opto-electrical devices or insulation in thin layers. However, at least two layers of material are used for supplementary insulation. In the latter case, one layer shall withstand the test voltage of 3750 V rms. Compliance shall be checked by inspection.

e. Equipment and components designed to meet the relevant creepage distance and clearance requirements of the following standards (which are equivalent to, or more stringent than, the previous requirements a through d), are satisfactory worldwide.

1.6.3 Communications Line Protection Barriers

For protection barriers protecting the communications line, the total width of the insulation between tracks (printed-circuit board lines) carrying protected circuitry and the source of excessive voltage on the same side of printed-wiring boards shall not be less than that specified in subhead 1.4.3.1. Compliance is checked by measurement.

1.6.3.1 Equipment that Requires Excess Voltage (250 V)

Equipment that requires a voltage in excess of 250 V dc or ac rms in any part of its circuitry for normal operation. For example, a high-voltage supply for a picture tube will only be permitted if the following requirements are met.

- All components associated with such a voltage shall be isolated in a manner appropriate to such a voltage. This isolation, which may be by means of separate metallic, insulating, or electrical containment, shall be provided between all components associated with greater than 250 V and components associated with 250 V or less. The level of safety must equal that achieved when providing 250 V grade double insulation against the intrusion of 250 V ac rms into safe parts of the equipment.
- Where the apparatus contains an excessive voltage greater than the relevant barrier voltage and the source of excessive voltage is current-limited, a single failure of insulation shall not cause an excessive voltage to appear at the communications line interface.

1.6.3.2 Excessive Voltage Greater than Barrier Voltage

Where the apparatus contains an excessive voltage greater than the relevant barrier voltage, excessive voltage shall be individually isolated using a construction method in accordance with the requirements specified in subhead 1.4. Compliance is checked by inspection.

1.6.4 Signal Transformers and Relays Used as Protection Barriers

Where the protection barrier consists of a signal transformer, an excessive voltage shall not appear on the protected circuit when the barrier voltage is connected to another winding. A transformer may be used to isolate excessive voltages provided one of the following requirements are met.

- The transformer is of a turns ratio, so that no voltage in excess of 50 V ac rms can be induced into the isolated winding(s) when the maximum ac voltage against which, under normal operation, protection is required, is applied across the non-isolated winding(s), or
- The transformer saturates at a flux value insufficient to induce a voltage in excess of 75 V ac rms into the isolated winding(s). In this case, a specification provided by the transformer manufacturer must be supplied to those administrations that require it showing that the transformer meets this requirement.

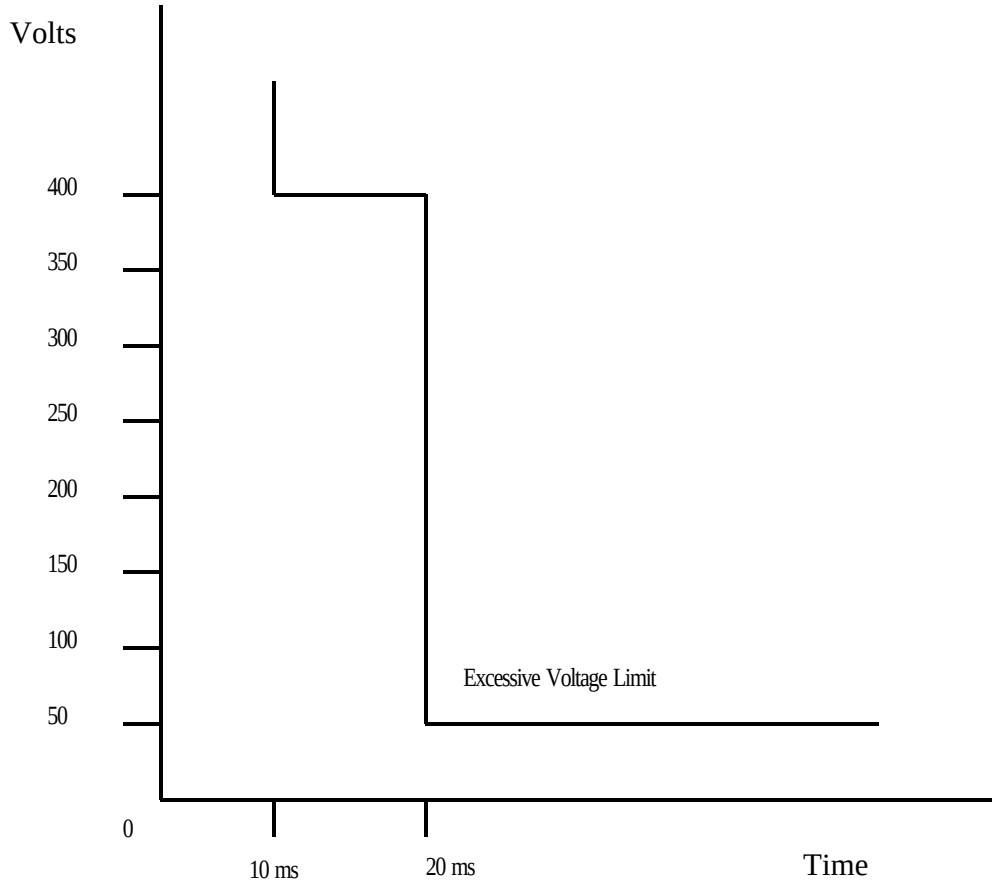
NOTE

Suitable precautions to achieve the conditions specified are the choice of a suitable turns ratio, saturation of the core material, or use of a voltage dependent device with or without a fuse. Digital part number 16-22226-02 meets all requirements and is recommended and certified by BSI 6301.

Toroidal transformers must comply with these requirements. Also, any lead out wires passing through any foil screen must be double insulated with an outer covering of a heat resistant sleeving of a type acceptable to the administration. Sleeving complying with BS 2757 Class H is considered acceptable by Hong Kong Telephone.

Compliance is checked by applying the barrier voltage to the unprotected winding. Under these test conditions, the voltage at the protected output shall remain within the voltage limits specified in Figure 6.

Figure 6: Voltage Limits at NTTP Port



1.6.5 Isolating Relays

Isolating relays are used to repeat signals between parts of circuits at excessive voltages and other parts at safe voltages. Such relays shall be constructed to give both electrical isolation and protection against any accidental contact. For example, from a loose part, between the components of the relay connected to one side of the safety interface, and those connected to the other side.

The isolation shall be provided by either of the means described in subhead 1.6.5.1.

1.6.5.1 Double Insulation

The use of double insulation is the preferred method and the physical construction requirements are as follows. Either:

- A physical barrier of rigid non-conducting material that will withstand 3.75 kV ac rms across its opposite surfaces shall be securely located between those relay components connected to the telecommunications line and those connected to the equipment side of the barrier interface. If there are contacts of the same relay opposite of the safety

interface, or coils of the same relay on opposite sides of the safety interface, a physical barrier affording double insulation shall also be provided between them, or

- The relay shall be totally enclosed in a case of non-conducting material, and depend on the enclosed airspace (physical isolation) together with electrical isolation, to the overall standard of double insulation between components on either side of the safety interface.

The following Digital part numbers are qualified and meet those requirements. Also, the parts are BSI certified.

1.6.5.2 Earth Protection

Use of earth protection and physical construction as follows: A physical barrier (a conductive screen or the frame or a metallic part of the relay) that is connected to a high mains earth or a communications earth of the highest integrity shall be interposed between the components of the relay connected to one side of the safety interface and those connected to the other side of the safety interface. This method is not recommended.

1.6.6 Capacitors as Protection Barriers

The use of capacitors as protection barriers at Digital is not recommended.

1.6.7 Opto-Electrical Devices

Opto-isolators may be used in lieu of transformers or relays as isolators of SELV circuits, as they are isolators of both ac and dc. Opto-isolators shall have a minimum isolation rating appropriate to the *line of defense* role they fulfill in the equipment in which they are installed. For example:

- When used to provide isolation to the standard of double insulation, the opto-isolator shall have a minimum breakdown voltage rating of 5 kV ac (peak) or dc or 3.5 kV ac rms.

  Note that SELV = 3750 V rms or 5302 V peak; 15.5 $\pm$ 0.3

- When used to provide only one line of defense equivalent to functional insulation, the opto-isolator shall have a minimum breakdown voltage rating of 1.4 kV ac (peak) or dc or 1 kV ac rms.

The opto-electrical device shall not be liable to deterioration of insulation under prolonged application of dc potential. Compliance shall be checked by inspection that the insulation between the input and output elements is air or a solid dielectric or a combination of the two, and where it is not, by the ionic drift test. The approved Digital part number is 19-21337-02.

1.6.8 Isolation Between Wiring and Terminations

Isolation between wiring and terminations of components directly associated with the telecommunications plant and those that have or may have excessive voltage on them, shall be provided by the following.

- Wiring and circuit traces must be separated by at least the same standard of insulation as the components that they connect where circuit isolation is involved.

For example, if a double-insulated transformer is used to isolate the logic circuits from the telecommunications interface, electrical isolation to the standard of double insulation is required between winding terminals, printed-circuit board tracks, and wiring connecting to the telecommunications plant and wiring connecting to the equipment, and

- Physical separation must be provided by means of a physical barrier or functional insulation. Also, distance separation must be sufficient to prevent any accidental cross-connection between components separated by electrical isolation.

1.6.9 Detailed Requirements for All Equipment

- The mains power supply cable and the telecommunications interface cable shall enter the equipment at different points. These points of entry shall be as far apart as practicable.
- The maximum physical separation practicable shall be provided between the points of entry of the telecommunications line and any external wiring connected to the circuitry in the equipment that is isolated from the telecommunications line.
- Mains power wiring in the equipment shall not be in a harness (wiring form) in common with any other wiring, unless such mains power wiring is double-insulated. Other internal wiring, which is not double-insulated from an excessive voltage, shall not be in the same harness (wiring form) as wiring associated with the telecommunications line.
- Any mains power ON/OFF switches or other switching devices mounted in the equipment shall be of the double-pole type. In the OFF position, the switch shall open both the active and neutral conductors of the mains power circuit. Note that a NO mains power ON/OFF switch is required.
- The termination of the power supply cable within the equipment shall be in accordance with DEC STD 119-0.
- The terminals for the power supply cable, the telecommunications line, and any other external wiring shall be clearly marked to reduce the danger of transposition with any other wiring.
- Where a double-insulated telecommunications line interface is used, all terminals and printed-circuit board tracks (lines) associated with the line shall be insulated by means of sleeving, spraying with insulating varnish, or by other suitable means to 250 V standard, except where the components associated with the line are in an enclosed compartment.

1.6.10 Detailed Requirements for Double-Insulated, Mains-Powered Equipment

- All components, such as fuses, switches, pilot lamps, and so on, that are connected to the ac power mains wiring shall either be double insulated or have equivalent isolation.
- A flexible mains power supply cord shall:
  - — In Australia, have only two conductors and not incorporate a safety earth ground conductor.

NOTE

A 2-pin plug may only be used in Australia if it is molded to the power supply cord, as C112 prohibits the use of rewirable 2-pin plugs for this purpose.

— Elsewhere be fitted with a plug for connection to the standard, general purpose (not necessarily grounded) power outlet socket in accordance with the local standard.

A communications line interface that is not isolated by a separate compartment shall be constructed as the following.

- Connections to the telecommunications line shall be made through a separate connector or connection points. The connections should preferably be at opposite ends of the printed-circuit board. However, if necessary, the two connections may be made at the same end, provided they are separated by the greatest distance practicable (minimum distance is 15 mm).
- At no point on the same side of a printed-circuit board shall tracks connected to the opposite side of the interface be closer than 5 mm.
- All wiring associated with the telecommunications line shall be in a separate harness (wiring form) from wiring associated with the other circuits in the equipment. Where practicable, the line wiring harness should be at least 15 mm from any other harness or other conductive material in the equipment, for example, a metal chassis. If this cannot be achieved, the telecommunications line wiring in the harness shall be insulated to withstand 3.5 kV ac rms.
- For telecommunication devices incorporated into mainframes or terminals, the connection shall be made directly to the interface circuits without a need of separate harness or intermediary connections (bulkheads, and so on). The interface area of the printed-circuit board must be covered with nonconductive cover on both sides of the board. This requirement is mandatory for products submitted to the BABT in order to avoid power supply testing to BS 6301.

1.6.11 Isolation of the Telecom Line from the External Metal of Equipment

Telecom Australia and the UK administration require that all equipment be enclosed in a case of non-conducting material to make it *all insulated* from the telecommunications line and the associated circuitry within the equipment.

Equipment that is metal-clad or equipment that has externally-mounted circuitry or components; for example, a heat sink, will only be permitted if either of the following requirements are met:

- The isolation between the metal case, or any other external metal components of the equipment, as well as the telecommunications line and its associated circuitry, shall be to the standards of 250 V grade double insulation, or equivalent. The requirement shall be met by the provision of a 15 mm clearance distance. However, this clearance may be reduced if a layer of insulant is fixed in the airspace, as equivalent to functional or protective insulation to form, with the reduced airspace, double insulation, or
- The exposed metal parts of the equipment shall be earth-protected by connection to a high-quality safety earth ground as required by Telecom Australia and insulation from the telecommunications line.

1.6.12 Connection of Dc Voltages from Equipment

No dc voltage (either relative to earth ground or isolated from earth ground) in equipment shall be connected to any two line conductors or to any one line conductor and earth ground associated with the Switched Telephone Network.

Except in specific circumstances dictated by the application, no dc voltage in equipment shall be connected to any two line conductors or to any one line conductor and earth ground associated with a telecommunications line.

Additional requirements, specific to the application and to the administration, must be met when a dc voltage is connected to the line. Refer to the applicable standards of the individual administration.

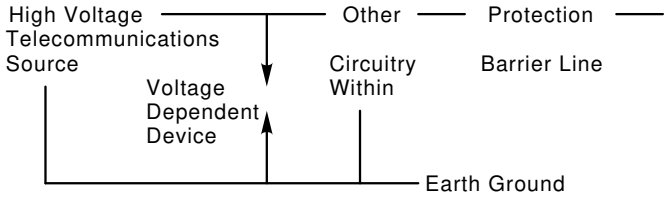
Voltage dependent device(s) may be incorporated on the side of an interface protection barrier, remote from the telecommunications line. Should the high voltage make contact with the barrier, the voltage would be clamped to a level that provides satisfactory protection for the barrier.

The voltage dependent device(s) must:

- Not conduct at a voltage (inclusive of tolerances) less than 360 volts.
- Conduct at a voltage not greater than that for which the protection barrier provides satisfactory protection.
- Be capable of continuously carrying a current of 5 amperes.
- Be of a type that upon failure exhibits a short circuit between its terminals.
- Prevent the transmission of excessive voltages to the telecommunications line for any period exceeding 250 ms.

Refer to Figure 7 for a typical example.

Figure 7: Possible Method of Protection Against High Voltage, Low Current Sources (Typical)



For example, the voltage dependent device might be a gas discharge tube.

Voltage dependent device(s) may be fitted to conductors connected to the telecommunications line. The voltage dependent device(s) may be part of a fuse disconnection barrier.

The voltage dependent device(s) must meet the following requirements.

- Conduct at voltages not exceeding those specified for the telecommunications line barrier above.

- Be capable of carrying without failure:
  - — The pulse power, including that discharge from any capacitance, that may be dissipated should the high voltage source come into contact with the barrier.
  - — The steady current that the high voltage source is capable of supplying. If a high voltage, low current source is contained within a device separate from, but associated with the equipment connected to the telecommunications line, the steady current from that high voltage source will generally be assumed to not exceed 180 mA. In this case, the pulse power will generally be considered as being adequately limited by the interconnecting circuitry.

    If Digital intends to adopt this method of protection, information and specifications must be provided to show the above requirements are met.
- By means of a high voltage protection barrier, the basic principle is that all barriers must be able to withstand a 50 Hz proof test voltage of 1500 ± 2 E volts for a full minute, where E is peak ac or dc voltage against which protection is offered.

  All other device operated from, containing, or associated with voltages in excess of 1000 volts ac (rms) or dc will be the subject of special consideration by the administration.

1.6.13 Acoustic Coupling

Acoustic couplers may be used as barriers, provided that the mechanical arrangements ensure that separation distances will exist between metal work of the transducers in the administration's telephone hand set and metal work of the transducers, in the equipment. Refer to Table 1.

Table 1: Acoustic Coupler Separation Distances

Maximum Peak Voltage in the Equipment	Minimum Separation (mm)
$\leq$ 500 V	3.0
> 500 V; $\leq$ 800 V	3.5
> 800 V; $\leq$ 1000 V	4.0
> 1000 V; $\leq$ 1250 V; ac only	4.5
> 1250 V; $\leq$ 1414 V; ac only	5.5

1.6.14 Other Devices, Techniques, and Construction Methods

Auto-transformers, potentiometers, and thermionic devices shall not be used as isolating devices.

NOTE

Methods of isolation should adopt good engineering practice for performance and reliability over the expected life of the apparatus.

A number of design factors that are likely to contribute to giving an adequate degree of protection are given in Appendix B.

1.6.15 Information to be Supplied by Digital

1.6.15.1 Information Required for Testing Purposes

Digital shall supply to the approving agency or its designate the classification of those characteristics of the apparatus for which alternative requirements exist, as given in Table 2.

NOTE

Digital or Digital's supplier should state the classification of the apparatus for the characteristics given in the table. In most instances, provision is made in the table for an appropriate classification to be adopted where no such statement is available. However, for the characteristic *user protection*, the classification cannot be determined without a statement.

For testing purposes, Digital shall state the following.

- All excessive voltages present in or supplied to the apparatus.
- The location and protective barrier voltage of the barrier components together with the type of insulation adopted in the protection barrier components or other measures meeting the requirements of subhead 1.6 that prevent the excessive voltage from reaching the communications line interface.
- The continuous power rating of each excessive voltage source with a continuous power rating of over 3 kW.
- Whether the protection between the communications line interface and user accessible parts.
- Whether protection of the user relies on a safety earth ground connection derived by way of a plug.

1.6.15.2 Instructions for Use

Instructions for use shall be supplied with the apparatus. The information shall be written in the native language(s) of the expected users and in English, as a minimum.

The instructions for use shall include the following information.

- A warning that interconnection directly or by way of other apparatus, of ports marked accordingly with ports not so marked, may produce hazardous conditions on the telecommunications line. Advice should be obtained from a competent engineer before such a connection is made.
- Where protection of the user relies on a safety earth ground derived by way of a plug (for example, a power mains plug), a warning:
  - — That the connection to the telecommunications line must be unplugged before the earth ground is disconnected.
  - — That the connection to the telecommunications line must not be hard-wired.
- Where appropriate, a repetition of the specified marking.
- Identification of the accessory ports.

- Where the apparatus requires to be connected to a separate power supply, the following statement: " Connection of power supply. This apparatus is intended for use when supplied with power. Power from other usage will invalidate any approval given to this apparatus if as a result it ceases to comply with BS 6301, *Safety Requirements for Apparatus for Connection to BT Networks*, 1982. [UK] "
- Where the apparatus is intended to be accessible only to authorized personnel, for example: an installation in a locked room or similar environment, the following statement: " Prevention of access by user. This apparatus is intended to be accessible only to authorized personnel. This apparatus must be installed in a locked room or similar environment, such that user-access is prevented. Failure to prevent such user-access will invalidate any approval given this apparatus. "

Compliance is checked by inspection.

2 QUALITIES RELATED TO DC VOLTAGE

2.1 POLARITY

The equipment design intended for direct connection to the PSTN network shall operate with an arbitrary polarity of the voltage applied to the line terminals of the equipment. Table 2 specifies dc voltages present in the telephone network.

Table 2: Telephone Exchange Parameters

Country	Exchange Voltage (V)	Exchange Current (mA)	Exchange Resistance (ohm)	Maximum Line Resistance (ohm)	Holding Loop Resistance (ohm)
Belgium	48	20 to 90	2x 200	1200	$\leq$ 400
Finland	45 to 53		2x 400	1800	$\leq$ 400
	56 to 66		2x 500	1800	$\leq$ 400
France	42 to 52	30 to 50	2x 150	1100	$\leq$ 200
			2x 200		
			2x 70		Refer to note.
			160 $\pm$ 150		
			150 $\pm$ 135		
Germany	58 to 60	17 to 60	1200 $\pm$ 0	1200	130 to 250
			500 $\pm$ 50		
Holland	42 to 48		2x 400	1000	60 to 200
	or 60		2x 250	1000	120 to 200
Italy	45 to 52		2x 400		
	57 to 64	$\leq$ 80	2x 500		
Japan	42 to 53	15 to 130[1]			
Norway	48	17 to 80		1500	$\leq$ 300
Sweden	20 to 30		2x 300	700	$\leq$ 400

[1]Exchange current will be greater than or equal to 15 mA with line termination of 300 ohms and less than or equal to 130 mA with line termination of 50 ohms.

NOTE

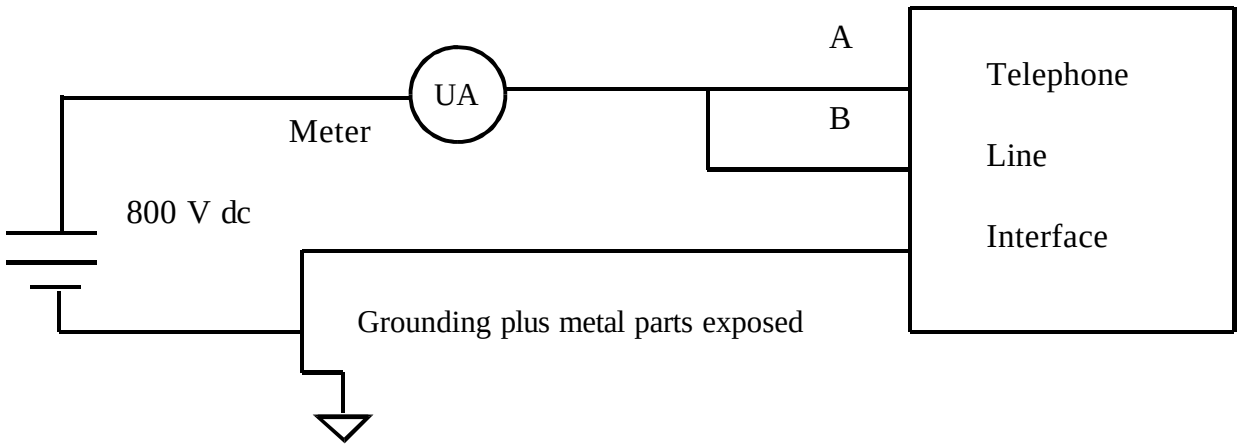
The French require current limiting in the form of a thermistor in the holding loop, as well as during pulse dialing. The approved part number appears in Appendix A.

2.1.1 Insulation Resistance

In equipment intended for direct connection to the PSTN network, the insulation resistance between the line terminals of each device shall be at least 5 megohms. The insulation resistance between the short-circuited line terminals of each device and earth/rack shall be at least 100 megohms. The insulation resistance will be tested at dc voltages of up to 500 V. Refer to heading 1 for safety requirements.

The insulation resistance shall be tested and verified in the circuit as shown in Figure 8.

Figure 8: Test Circuit for Testing Insulation Resistance

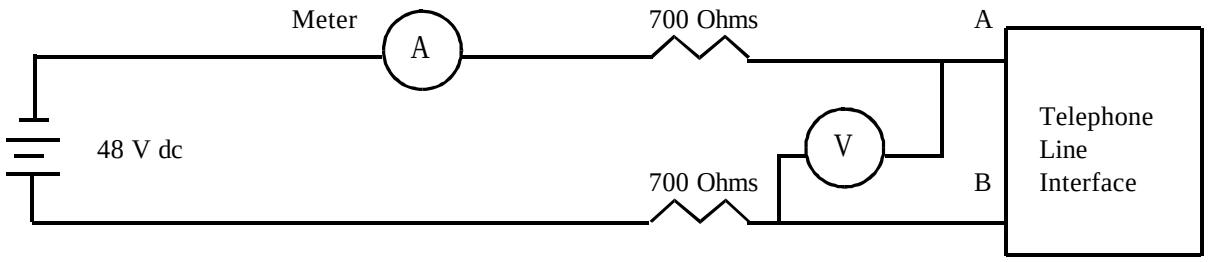


In equipment in loop condition, the insulation resistance between any of the line terminals and earth/rack shall be at least 100 megohms, tested at dc voltages of up to 500 V.

2.1.2 Loop Resistance

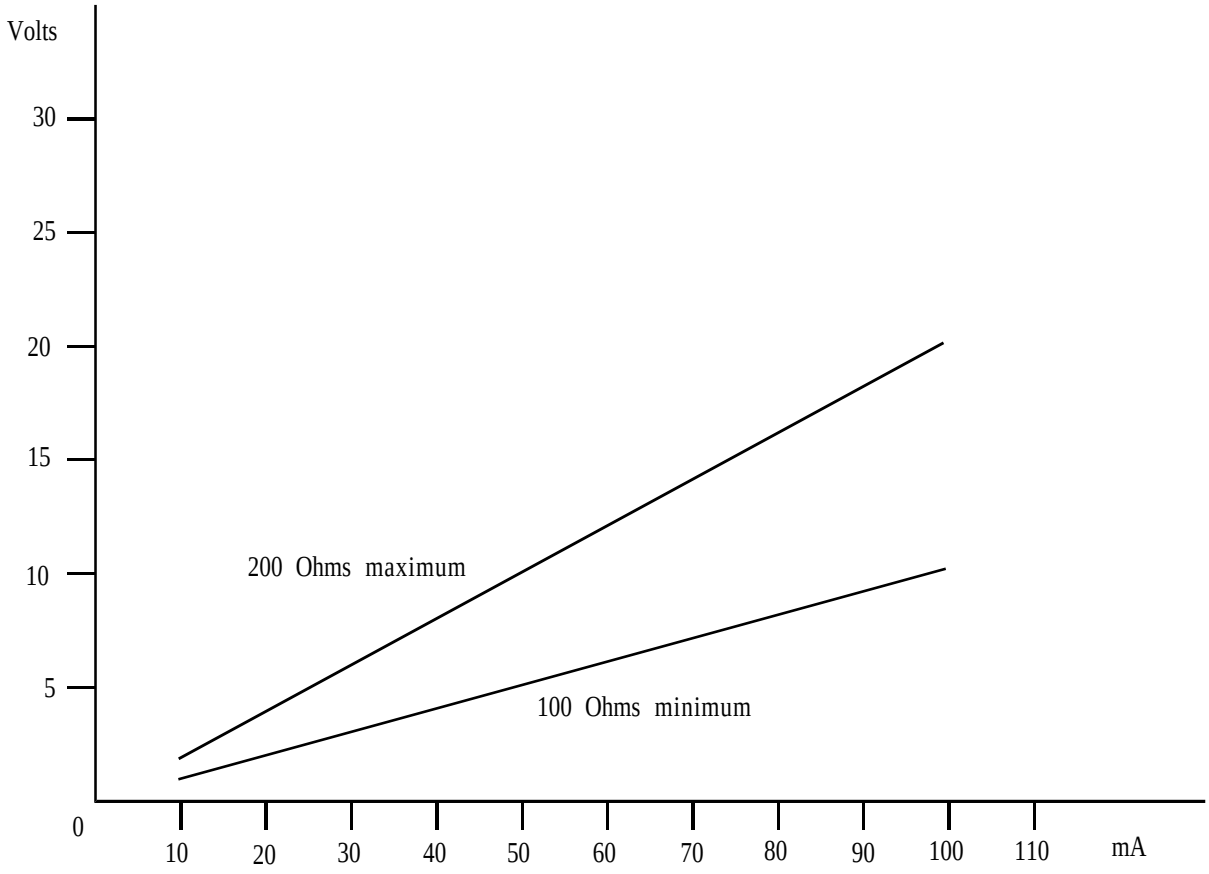
In loop condition, there shall be a dc loop between the line terminals of the equipment. The dc loop is intended for direct connection to the PSTN network with an equivalent loop resistance (of 200 ohms maximum) for line currents of up to 120 mA. Refer to Table 1 for reference. When checking the loop resistance, the measuring set-up shown in Figure 9 shall be used.

Figure 9: Measuring Setup



Refer to Figure 10 for loop resistance limits.

Figure 10: Loop Resistance Limits



2.1.3 Transient Response of the Loop Current

In the equipment intended for direct connection to the PSTN network, a change from quiescent condition to loop condition, or when in loop condition, the dc loop mentioned in subhead 2.1.2 shall be maintained in a certain manner. In connection with switch-overs in the equipment (intended for direct connection to the PSTN network), no interruptions, rebounds, or similar phenomena will occur for so long that the qualities of the dc loop will not be re-established in the course of 5 ms, maximum.

2.1.3.1 Dialing with Loop Pulsing

When dialing is carried out with loop pulsing from the equipment, a spark quench must be connected in parallel to the dial pulse switch. This should consist of a resistor (R) in series with a capacitor (C). The values of R and C must be in the range of 560 to 1000 ohms and 0.47 to l.5 µF.

NOTE

For the particular spark quench circuit required for a specific country, refer to subhead 5.3.2.1.

When dialing is carried out with loop pulsing from the equipment, the dc loop mentioned in subhead 2.1.2 shall be re-switched, so that the loop current will reach 90% of its stationary value in 2 ms when a voltage of 48 V is applied to the line terminals of the equipment through 2 x (200 to 700) ohms.

To prevent mutilation of dialing information, the loop shall be non-inductive. This is accomplished by short-circuiting or bridging all circuits in the loop, except for those required for the dialing function. This short-circuiting shall commence 10 to 100 ms before the start of the transmission of each pulse train and end 10 to 100 ms after the termination of each pulse train.

2.1.3.2 Dial Pulse Requirements

Table 3 lists dial pulse requirements.

Table 3: Dial Pulse Requirements

Impulse Type	Impulse Speed (PPS)[1]	Impulse Make Ratio[2]	Minimum Pause[3]
10 PPS	10 ± 0.8	33 ± 3%	600 ms or longer
20 PPS	20 ± 1.6	33 ± 3%	450 ms or longer
30 PPS	10 ± 0.8	40 ± 3%	600 ms or longer

[1]The number of the dial pulse cycle in a second.

[2]An impulse make-and-break interval ratio as defined by the equation: [(Make Interval)/(Make Interval + Break Interval)] X 100.

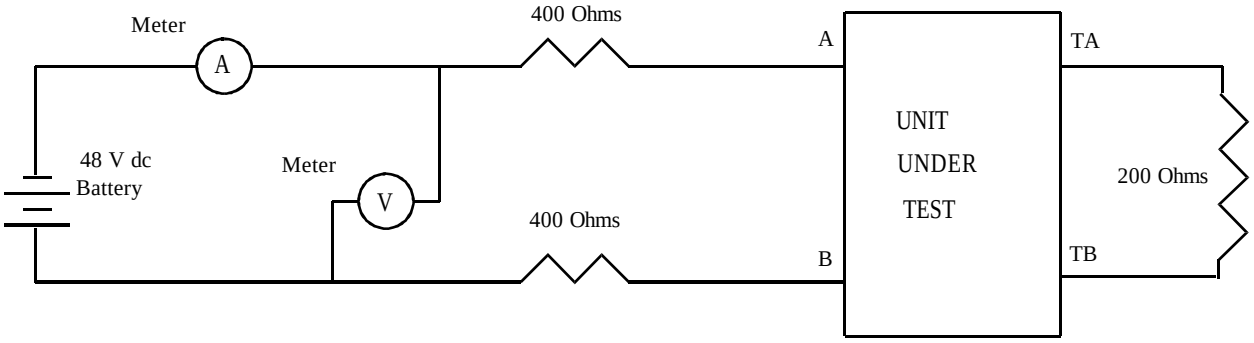
[3]The minimum permissible interval between the succeeding impulses.

2.1.4 Series Resistance

Any device that is connected in the series between a terminal and the line should not increase the line resistance by more than 20 ohms. Refer to subhead 4.3.

In order to check the value of the series resistance, the principle of the measuring set-up shown in Figure 11 shall be used. The series resistance is calculated by the formula: U/I - (2R + Ra) ohm.

Figure 11: Series Resistance Measurement Circuit



2.1.5 Electric Load

The equipment in loop condition shall continuously be capable of standing the power supplied to it, when a dc voltage of 66 V is applied to the line terminals through a 220-ohm resistor, or a line current 125 mA.

3 QUALITIES RELATED TO RINGING SIGNAL FREQUENCIES

3.1 RINGING SOURCE DESCRIPTION

Table 4 gives information relating to automatic ringing sources. It should be noted that generally the ringing current is supplied to the line via a relay coil of variable inductance, which may have a value of up to 6 H, at the ringing frequency.

The telephone line contributes resistance of up to maximum dc loop value, as stated in Table 4. During the ringing period, both dc and ringing frequency signals may be present on the line.

Table 4: Ringing Sources

Country	Level Volts (rms)	Frequency (Hertz)	Sequence (seconds)	Ringing Det. Impedance
Austria		25 to 50		
Australia				
Belgium	75	25 ± 2.5	ON 1; OFF 3	
Finland	75 ± 20%	25 ± 3	ON 1 ± 25%	
		50 ± 3	OFF 4 ± 6.25%	
France	60 to 80	25 ± 2.5	ON 1.7; OFF 3.3	
		50 ± 5	ON 1.5; OFF 3.5	
Germany	50 to 60	25 ± 2	ON 1; OFF 4	
			ON 1; OFF 5	
Holland	45 to 90	25 ± 2	ON 1; OFF 4	
		50 ± 5		
Italy	30 to 70	25 ± 2	ON 1; OFF 4.5	

Table 4 (Cont.): Ringing Sources

Country	Level Volts (rms)	Frequency (Hertz)	Sequence (seconds)	Ringing Det. Impedance
Japan	65 to 83	15 to 20	ON 1 ± 10%	
Norway	25 to 100	20 to 55	ON 1; OFF 4	
			0.3, 0.4, 0.4; OFF 4	
Portugal	35 to 120	25 ± 5%	ON 1; OFF 3	
		16.6 ± 10%		
Spain	75 ± 15%	25 ± 20%	ON 1.5; OFF 3 ± 20%	
Sweden	70 to 120	23 to 28	ON 1; OFF 9	
		50	ON 1; OFF 5	
Switzerland	90, 70	25 ± 3	ON; OFF 4	
		50		
United Kingdom	70 to 100	16 to 25	ON 0.4; OFF 0.2	
			ON 0.4; OFF 4	

3.2 RINGING DETECTION

The ringing detector shall be incorporated in the equipment connected to the PSTN network. The indication of reception of a ringing condition in a modem shall be presented as ON condition on circuit RI (125) and shall follow the ringing signal envelope.

The auto answering equipment, where answering is caused by detecting ringing, shall connect to the telephone line during OFF time of the ringing signal. That condition shall be observed for automatic or manually answered calls. The minimum time required to seize the line shall be 2 seconds from the time the first ring pulse was recognized, or a minimum of two ring pulses shall be allowed before the equipment connects to the line. Under no circumstances should the equipment connect to the line sooner than 2 seconds. Refer to subhead 6.2 for more details.

Isolating arrangements shall be provided to ensure that no dc current flows into the ringing detector. The detector shall be isolated from the ground and shall not degrade the isolation barrier, as specified in subhead 1.4.

3.3 INPUT IMPEDANCE

The quiescent condition, in the equipment intended for direct connection to the PSTN network, shall have an input impedance of at least 7 Kohms at rms ac voltages of up to 120 V and frequencies within the frequency range of 16 to 55 Hz. In some cases, when the ring detector circuit is in parallel with the associated telephone, the impedance is higher than 7 Kohms.

3.4 IMPEDANCE TOWARDS EARTH

Between the short-circuited line terminals and earth/rack, the equipment shall have an impedance with an absolute value of at least one megohm at ac voltages, with effective values of up to 120 V and frequencies of up to 55 Hz.

3.5 ELECTRIC LOAD

The equipment shall be capable of standing the power that is supplied to it. When a dc voltage of 66 V, superimposed with an ac voltage of 135 V, is applied to the line terminals through a resistor of 500 ohms for 2 seconds, after a change from quiescent condition to loop condition, the frequency of the ac voltage is in the range of 16 to 55 Hz.

3.6 INSERTION LOSS

The insertion loss, in relation to ringing signal frequencies, shall not exceed 1 dB at 16 and 55 Hz (measured between the 5 Kohm generator impedance and an 8 Kohm load impedance) with a generator rms voltage of 75 V ac.

4 QUALITIES RELATED TO VOICE FREQUENCIES

4.1 INPUT IMPEDANCE

In the quiescent condition, the equipment shall have an input impedance with an absolute value of at least 50 Kohms, at rms ac voltages of up to 3.5 V. The equipment shall also have frequencies from 200 Hz to 4000 Hz. At frequencies within the range of 4000 Hz to 18000 Hz, the impedance shall be at least 10 Kohms.

4.1.1 Return Loss

In loop condition, the equipment shall have an input impedance of which the return loss, in relation to a resistance of 600 ohms, shall be at least 16 dB, within the frequency range of 200 to 4000 Hz.

However, this requirement need not be complied with:

- During the period from reception of the dialing tone until the transmission equipment has been connected after dialing with loop pulsing, and
- During the period from the establishment of the dc loop until the transmission equipment has been connected after the answering of a call.

The requirement for the return loss shall be complied with at rms ac voltages of up to 2.5, when a dc current of up to 110 mA is applied to the line.

The return loss of the input impedance, in relation to a resistance of 600 ohms, 20 log 10 [(Z + X)/(Z - X)] dB, in which Z is the input impedance (complex value) and X = 600 ohms.

At the control of the return loss, the measuring set-up shown in Figures 12 and 13 are used. Here, the return loss is determined by: 20 log 10 (2.5/u) dB.

Figure 12: Return Loss Measurement - PSTN Setup

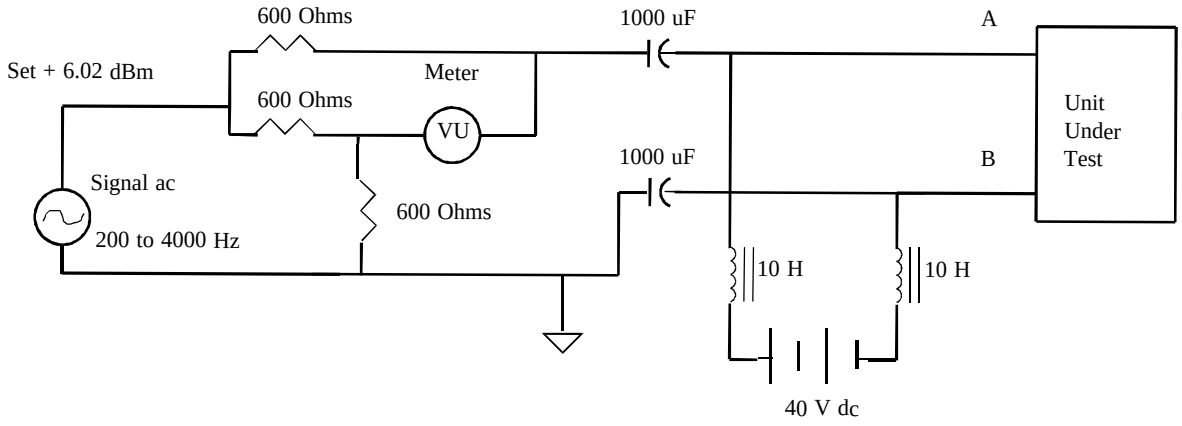
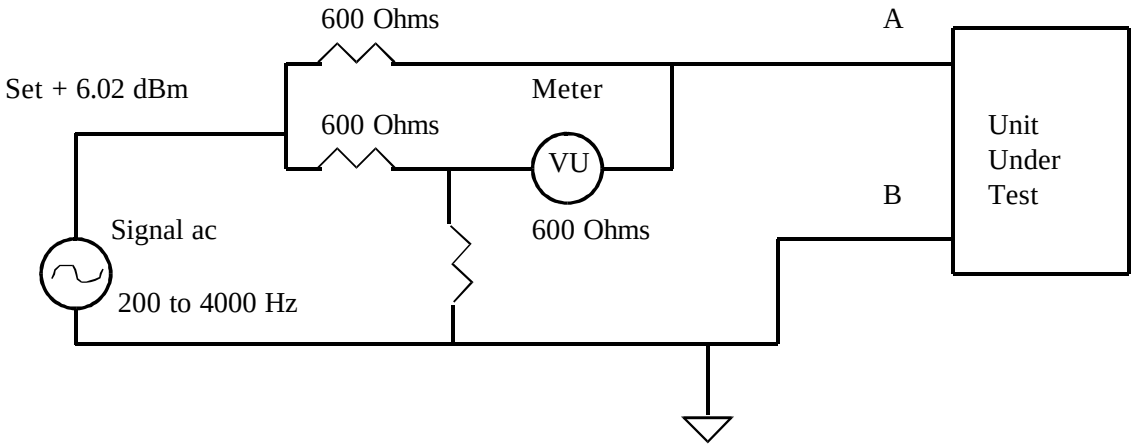
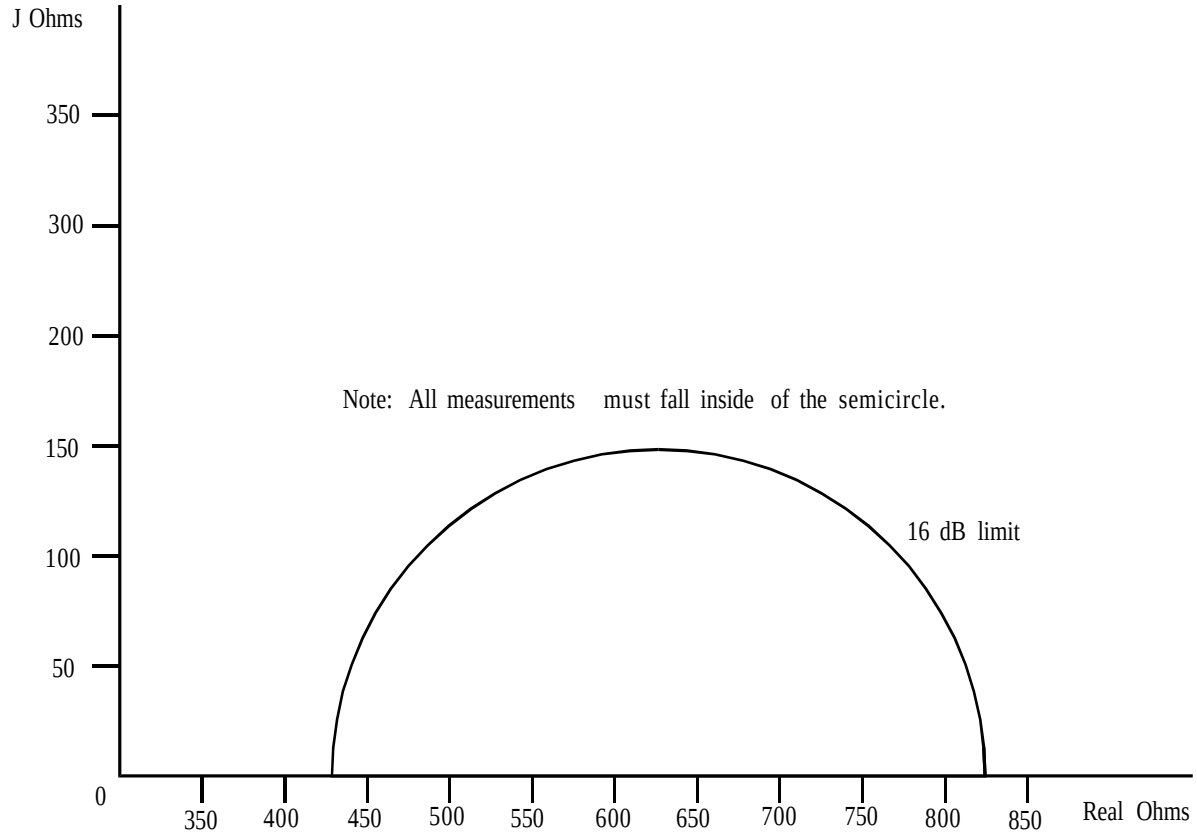


Figure 13: Return Loss Measurement - Lease Line Setup



The test results shall be plotted on an x-y coordinate axis representing R+ jomega relative to 600 ohms resistive load. Refer to Figure 14.

Figure 14: Representative Return Loss Plot



4.2 IMPEDANCE BALANCE TO EARTH

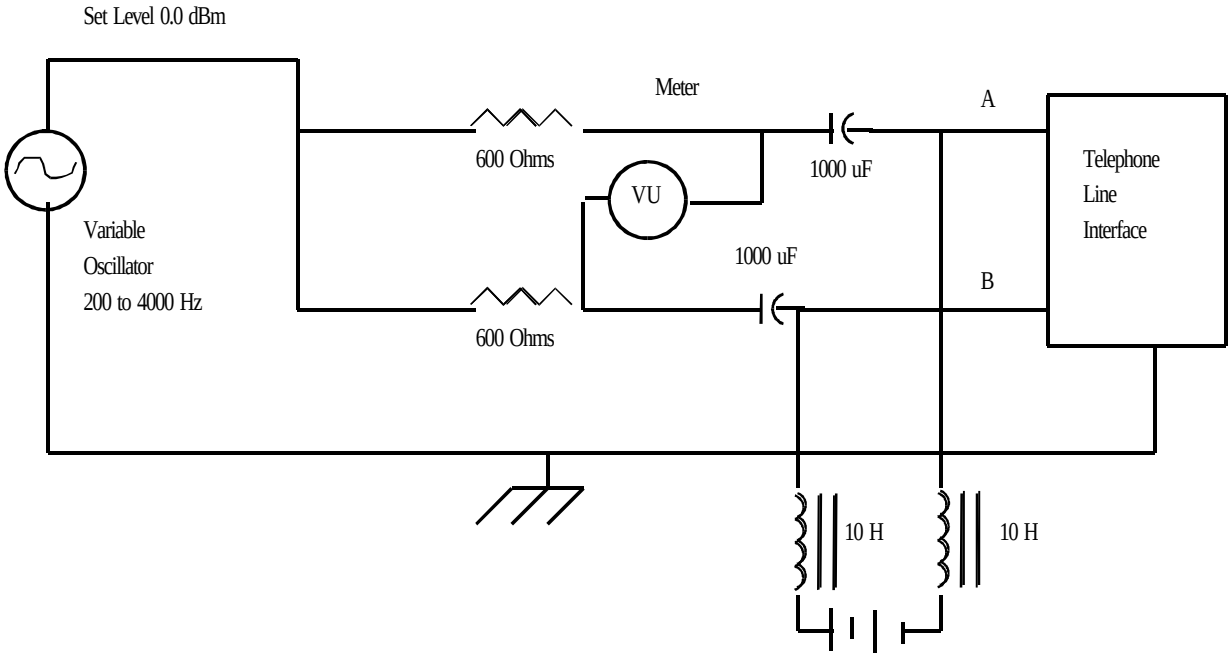
Both in quiescent condition and in loop condition, the equipment shall have an impedance balanced to earth $\leq$ 55 dB over a frequency range of 400 to 3400 Hz.

To measure the balance to earth, the measuring set-up shown in Figure 15 is used. Here, the degree of balance to earth is determined by: 20 log 10 (0.775/µ) dB. The measuring of µ V is carried out with the switch, S, open as well as closed and with the switch, K, in both positions.

NOTE

If the meter is calibrated in dBm, the reading of return loss is direct on the meter. The resistors used should be matched to 0.1% of each other.

Figure 15: Impedance Balance Measurement



Refer to Table 5 for ac requirements for line interface.

Table 5: Ac Requirements for Line Interface

Country	Terminating Impedance (Ohm)	Return Lost (dB)	Unbalance Ratio (dB)
Austria	600	14 2W Cct	46
	600	20 4W Cct	
Belgium	600	15	48
Finland	600	15	40
			40 to 300 Hz
			50
			300 to 600 Hz
			55
			600 to 3400 Hz
France	600	14	46
Germany			
Italy	600	14	50

Table 5 (Cont.): Ac Requirements for Line Interface

Country	Terminating Impedance (Ohm)	Return Lost (dB)	Unbalance Ratio (dB)
Japan	600	2[1]	
Netherlands	600	14	50
Norway	860 Ohm +40 nF in parallel	9	46
			200 to 600 Hz
	600 Ohm 4W Cct		50
			600 to 3400 Hz
Portugal	600	14	50
Spain	600	14	40
			40 to 300 Hz
			50
			300 to 600 Hz
			55
			600 to 3400 Hz
Sweden	900 Ohm +30 nF in parallel	6	40
			300 to 600 Hz
	600 Ohm 4W Cct	(14 under study)	46
			600 to 3400 Hz
Switzerland	600		56
United Kingdom	600	16	46
			200 to 4000 Hz

[1]Measured with special circuits and by adding specific frequencies with -35 dB signals. Measurement data is required for this special condition

4.3 INSERTION LOSS

The equipment, in which a connection is through-connected to another part of the subscriber's installation, shall contribute an insertion loss of, at the most, 0.2 dB to the transmission loss of the combined connection within the frequency range of 300 to 3400 Hz.

The check to ascertain whether the requirement is complied with is made by measuring the insertion loss of the equipment between resistances of 600 ohms, at voltages with effective values of up to 2.5 V.

4.4 TRANSMISSION LEVELS

The equipment shall not emit signals with peak values of more than 1.5 V between the line terminals.

4.4.1 Transmission of Voice

At the transmission of alternating currents originating from speech and music, no power shall be emitted from the equipment in loop condition. The equipment in quiescent condition, on an average rms for any period of duration of 10 seconds, shall not exceed 100 uW (-10 dBm) when the line terminals of the equipment are loaded with a resistance of 600 ohms. Refer to Table 6.

Table 6: Transmit Levels

Country	PSTN (dBm)	Lease Line (dBm)	Voice (dBm)	DTMF Tones (dBm)
Australia	-10	10		
Austria	-10			
Belgium	-6		-10	-6 ± 2 hf
				-8 ± 2 hf
Denmark	-10	-10	-10	-11 ± 2 hf
				-9 ± 2 hf
Finland	-10			
France	-6		-10	-6 ± 2 hf
				-8 ± 2 hf
Germany	-6		-6 dBV	-4 total
Holland	-6	-6	-6	-6 total
Hong Kong				
Ireland	-5 to -10	0		
Japan[1]	adjustable or -15 fixed	adjustable or -15 fixed	not specified	adjustable or fixed to -9 to -6.5 hf; -10.9 to -6.5 lf
Norway	-2 to -14			-9 ± 2 hf
				-11 ± 2 lf
Portugal				
Spain				-4 ± 2 hf
				-6 ± 2 lf
Sweden	-10	-10	-6	-9 ± 2 hf
				-11 ± 2 lf
Switzerland	-6		-3	
United Kingdom	-9	-13	-6	-9 ± 2 hf
				-11 ± 2 lf

[1] Adjustable range is from 0 to -15 dB by one dB step.

4.4.2 Transmission of Data

At the transmission of code signals, with the exception of DTMF, in the form of alternating currents, the equipment in loop condition shall emit no power, which on an average for any period of duration of 0.2 second, exceeds:

For country-specific levels, refer to Table 6.

The general requirement is to provide adjustable attenuator capable to adjust level in 1 dB steps, from maximum output of 0 dBm to -15 dBm, respectively. Under no circumstances shall the equipment output levels be greater than 0 dBm.

The tolerance for the attenuator shall be ± 0.5 dB. If the equipment is not capable to set transmit levels via attenuator, then the transmit levels shall be fixed according to Table 6 for the appropriate country settings before the equipment is shipped.

- 33 dBm for 3.4 kHz to 4.3 kHz,
- 37 dBm for f = 4.3 kHz and then falling 12 dB/octave up to 16 kHz,
- 70 dBm for frequencies above 16 kHz, when the line terminals of the equipment are loaded with a resistance of 600 ohms.

Table 6 summarizes country requirements at the PSTN and leased line transmit levels.

This requirement for the mean power shall be complied with even if a code signal contains one or more frequencies and it is sent continuously or intermittently with a constant or varying amplitude and/or frequency.

In the event that alternating currents originating from speech, music, and code signals are sent at the same time from the equipment in loop condition, the total mean power emitted shall not exceed the limits as specified in Table 6, when the line terminals of the equipment are loaded with a resistance of 600 ohms.

In this connection, the mean powers shall be determined as stated in subheads 4.3 and 4.3.1, respectively.

5 EQUIPMENT WITH CALLING FUNCTION

5.1 GENERAL

The equipment may be arranged so that after manual or automatic start, it can wholly or partly perform one or more calling functions automatically. For example, it can start a call, receive the dial tone, carry out the dialing, switch in transmission equipment, or put through an established connection to another part of the subscriber's installation.

Each individual call shall begin with the establishment of loop condition, either in the equipment or in the other part of the subscriber's installation.

In the equipment, the dialing shall not commence until the dialing tone from the public switched telephone network has been received.

5.2 DIAL TONE RECEPTION

The equipment with a dial tone receiver shall, during the period from the beginning of the call to the reception of the dial tone, comply with the requirements for dc loop and input impedance, which are stated in subheads 2.1, 2.l.2, 2.1.3, and 4.1.1.

In the equipment with automatic start of dialing, the dial tone detector shall be activated and have commenced dialing 2 seconds at the latest. This shall happen after the time when, in loop condition, a dial tone in the form of a continuous ac, in the frequency range of 400 to 450 Hz and a level of 0 dBm to -41 dBm, is received.

In the equipment with automatic start of dialing, the dial tone receiver shall not be activated when, in loop condition, the below ac voltages, and so on, are applied to the line terminals of the equipment:

- Ac voltages for periods of duration of less than 1 second and with effective values of up to 1000 mV; impressed on the line at intervals of 250 ms.
- Continuous ac voltages at levels below -45 dBm.
- Continuous ac voltages with frequencies of up to 160 Hz and with effective values of up to 1000 mV.
- Single, stray, short noise pulses with peak voltages of up to 100 V.

At the check made to ascertain whether the latter requirement is complied with, the measuring set-up shown in Figure 17 is used.

5.3 DIALING

5.3.1 Dialing Procedure

The first step in dialing a number is seizing a telephone line. Seizing is defined here as creating a direct-current connection between terminals a and b (tip and ring).

After the telephone line has been seized, the equipment must not commence the dialing procedure before receiving and identifying the first dial tone from the telephone exchange.

When dialing a long distance (trunk) number, after transmitting the area code number, the equipment must wait for the second dial tone before continuing the dialing procedure, if provided.

When dialing an international number, after transmitting the international access code, the equipment must wait for the second dial tone before continuing the dialing procedure.

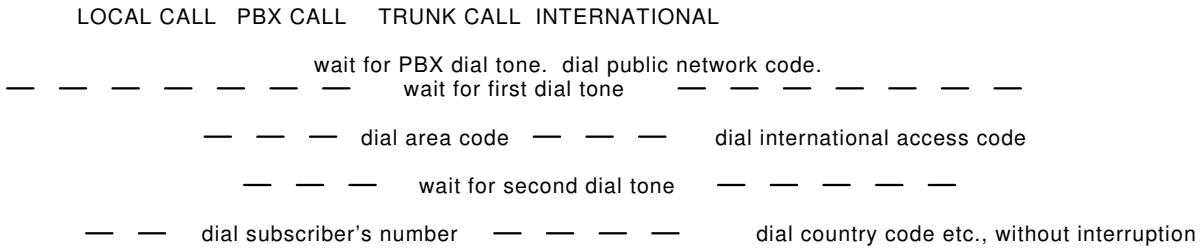
If the equipment is connected to a house or business telephone installation with its own PBX system, it must not start the dialing procedure before receiving and recognizing the installation's internal dial tone. After access has been obtained to the external telephone line (public network), the equipment may only continue the dialing procedure after the first dial tone has been received and recognized.

The equipment must be capable of waiting for a dial tone for a maximum period of 40 seconds and a minimum period of 10 seconds. Those times must be selectable by the manufacturer and not alterable by the user. If no dial tone has been detected within this time, the line must be cleared. Clearing is defined here as breaking the direct-current connection between terminals a and b and remaining in that state for a period of 5 seconds.

If a busy (engaged) or congestion tone is obtained during dialing, the line must be cleared.

The sequence of the various dialing operations for the different types of call is given in Figure 16.

Figure 16: Sequence of Dialing Operations



After the line has been cleared as a result of the absence of a dial tone, or as a result of receiving an engaged or congestion tone, the equipment should wait for at least 5 seconds before seizing the line again. The autodialing requirements are included in Appendix A.

If the number information disappears or is mutilated as a result of an interruption in the main voltage, the equipment must not seize the line again until the number has been re-programmed.

If the equipment is designed for remote programming, the administration accepts no responsibility for number information provided in this manner, nor any responsibility in case of unauthorized use.

Dialing with preset waiting times before and between sequences of digits in the dialed number is not permitted. If there is no dial tone detector, only dialing by ear (acoustic dialing) is permitted. In acoustic dialing, the dialing procedure is manually initiated or continued, as soon as the dial tone is audible via the telephone handset or, where applicable, a loudspeaker fitted to the equipment.

5.3.2 Dialing with Loop Pulsing

Dialing with loop pulsing shall be effected as a series of breaks (break pulses) of the dc loop.

During the dialing with loop pulsing from the equipment, the dc loop between the line terminals shall comply with the requirements stated in subheads 2.1, 2.1.5, and 3.6.

From the time a call has been commenced to the time the transmission equipment has been switched in after a dialing with loop pulsing, the equipment shall not emit any ac voltages, apart from those caused by the break pulses, which, over the line terminals of the equipment loaded with a resistance of 600 ohms, have an effective value of more than 77.5 µV.

5.3.2.1 Spark Quenching Circuit

To obtain the correct pulse form and to prevent undesirable voltage peaks, a *spark-quenching circuit* or RC filter should be fitted in parallel with the pulse (break) switching element. This should consist of a resistance within the range of 100 to 600 ohm and a capacitor within the range of 1 to 2 µF at a specified nominal operating voltage of at least 250 V, connected in series.

5.3.2.2 Pulse Digit Designation

At dialing with loop pulsing, the number of break pulses for each digit shall correspond to the digit value. However, the digit value of 0 shall correspond to 10 break pulses. For each digit, the break pulses shall be emitted with a nominal frequency of 10 ± 1 Hz. The alternative method referred as *Z type dialing* is used in parts of Norway and in New Zealand. The digit 0 is represented as one pulse and digit nine as string 10 pulses. The equipment designed to operate in those regions shall have the ability to provide such an option.

Table 7 summarizes three different dialing methods.

Table 7: Dialing Methods

Number of Pulses	Digit	Digit	Digit	Notes
	U.S., Canada, Europe	Sweden	Oslo, Norway, New Zealand	
1	1	0	9	
2	2	1	8	
3	3	2	7	
4	4	3	6	
5	5	4	5	
6	6	5	4	
7	7	6	3	
8	8	7	2	
9	9	8	1	
10	0	9	0	

At a nominal frequency of 10 Hz, the break period shall be nominal 60% with a range of 58 to 64% or nominal 67% with a range of 64 to 70%, according to the Administration's requirements. Refer to Table 8.

Table 8: Dial Pulse

Impulse Type	Impulse Speed (PPS)[1]	Impulse Make Ratio[2]	Minimum Pause[3]
10 PPS	10 ± 0.8 PPS	33 ± 3%	600 ms or longer
20 PPS	20 ± 1.6 PPS	33 ± 3%	450 ms or longer

[1]The number of the dial pulse cycle in a second.

[2]An impulse make-and-break interval ratio as defined by the equation: [(Make Interval)/(Make Interval + Break Interval)] X 100.

[3]The minimum permissible interval between the succeeding impulses.

At dialing with loop pulsing, the interdigit period, for example, the period from the rear edge of the last break pulse for a digit to the front edge of the first break pulse for the following digit, shall be 450 to 650 ms or 800 to 1000 ms.

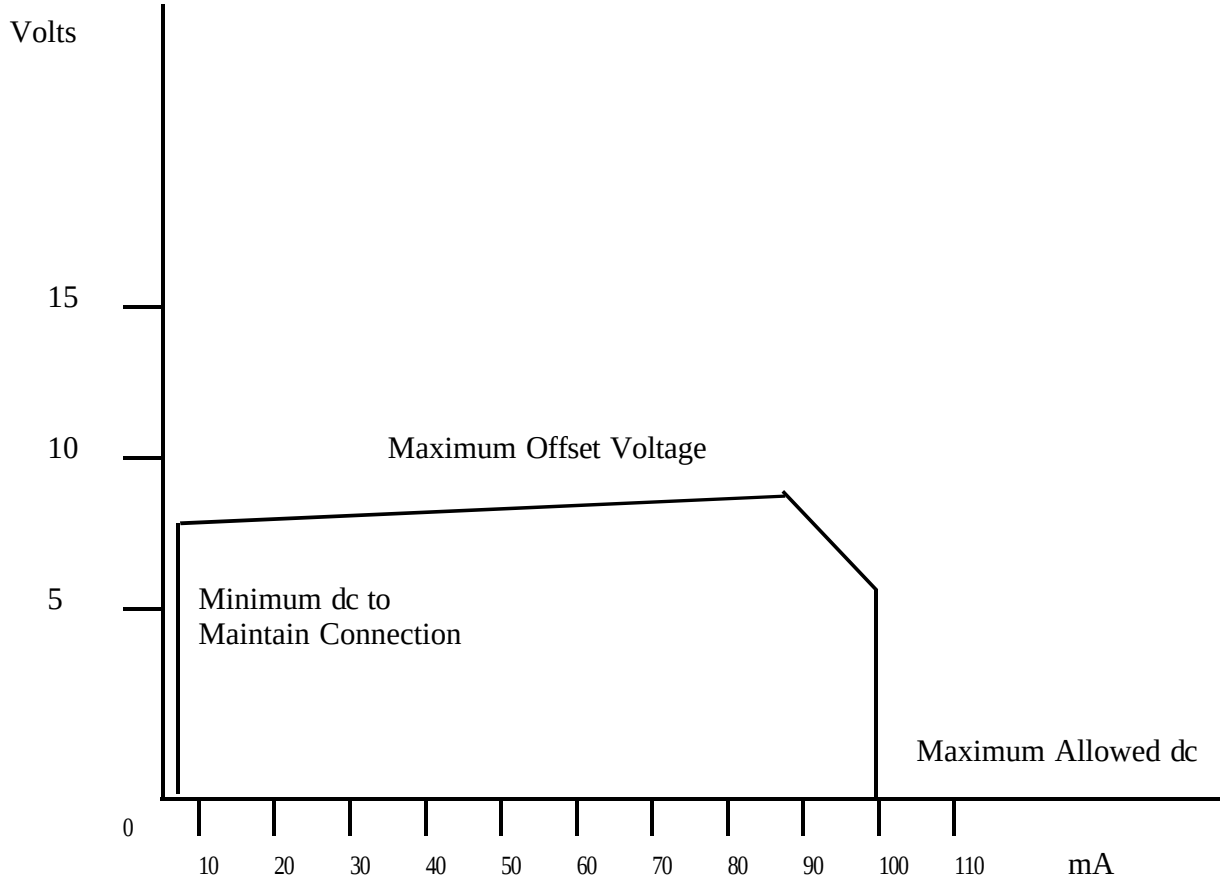
5.3.2.3 Mechanical Devices

During the periods between the break pulses and 5 ms after the last break pulse for each digit, there shall be a dc loop between the line terminals of the equipment with an equivalent loop resistance of 10 ohms maximum for line currents of up to 100 mA.

5.3.2.4 Electronic Devices

During the periods between break pulses and 5 ms after the last break pulse for each digit the characteristics of Figure 17 shall be met.

Figure 17: Dc Characteristics Impulse Dialing State



The pulsing loop shall be maintained for at least 25 ms after the final make transition in a pulse train.

In the periods during the break pulses, when a voltage of 48 V dc is applied to the line terminals of the equipment through 2 x 400 ohms, the current should not exceed 0.25 mA.

5.4 DIALING WITH DTMF PULSES

Dialing with multifrequency pulses shall be carried out through the emission of code signals in a multifrequency system according to Rec. T/CS 46-02.

During dialing with multifrequency pulses from the equipment, the equipment shall comply with the requirements for dc loop and input impedance, which are stated in subheads 2.1, 2.1.2, 2.1.3.1, and 4.1.1. Refer to Table 9.

Table 9: DTMF Tones

Signal	Component Frequency
1	697 Hz and 1209 Hz
2	697 Hz and 1336 Hz
3	697 Hz and 1477 Hz
4	770 Hz and 1209 Hz
5	770 Hz and 1336 Hz
6	770 Hz and 1477 Hz
7	852 Hz and 1209 Hz
8	852 Hz and 1336 Hz
9	852 Hz and 1477 Hz
0	941 Hz and 1336 Hz
*	941 Hz and 1209 Hz
#	941 Hz and 1477 Hz
A	697 Hz and 1633 Hz
B	770 Hz and 1633 Hz
C	852 Hz and 1633 Hz
D	941 Hz and 109 Hz

The following are signal component frequency variations.

- Variation: 1.5% of nominal value signal output level

- Low group frequencies:

  697 Hz
  770 Hz
  852 Hz
  941 Hz

- High group frequencies:

  1209 Hz
  1226 Hz
  1477 Hz
  1633 Hz

- Signal-on time: 70 ms or longer
- Minimum pause: 50 ms or longer
- Cycle time: 120 ms or longer (signal-on time plus minimum pause)
- The transmitted levels shall have a 2 dB twist between low and high frequency group.
- Minimum pause is the minimum permissible interval between succeeding signals.

5.5 SWITCHING OF TRANSMISSION EQUIPMENT

The equipment with calling function shall switch in the transmission equipment within 1 second after the completion of a dialing.

5.6 DURATION OF LOOP CONDITION

In the equipment with automatic calling function and exchange of information via an established connection, the loop condition shall at each call be succeeded by quiescent condition within 1.5 minutes after the completion of the dialing, unless the observation of the loop condition for more than 1.5 minutes is controlled by the information exchanged via the connection.

At a call from the equipment, in which the duration of the loop condition in excess of 1.5 minutes is controlled by the information exchanged via an established connection, the loop condition shall be succeeded by quiescent condition 20 seconds at the latest, after the latest information has been sufficient for continued preservation of the loop condition.

5.7 REPETITION OF A CALL

The equipment may be arranged for automatic start and performance of several successive call attempts to the same or various numbers in arbitrary order.

The following conditions apply:

- Frequency of successive call attempts to one number:
  - — Five seconds between first and second attempt
  - — One minute between subsequent attempts

- Total number of successive call attempts to one number:

  A maximum of four call attempts within one hour of the initial attempt, except for alarm and telemetry calls to which a maximum of 15 should apply.

Manual intervention shall be required before further call attempts are made automatically to the call address. For country-specific requirements, refer to Appendix A.

5.8 IDENTIFICATION SIGNAL

The equipment with automatic calling function, 5 seconds after the last dialed digit at the latest, shall emit an identification signal either in the form of a code signal or as a verbal announcement.

An identification signal, in the form of a code signal, shall consist of one or more frequencies in the frequency range of 800 to 2200 Hz. It shall be emitted continuously or intermittently until a correct identification signal has been received from the called subscriber, or until the loop condition has been succeeded by the quiescent condition.

An identification signal, in the form of a verbal announcement, shall be repeated or sent continuously until a correct identification signal has been received from the called subscriber, or until the loop condition has been succeeded by the quiescent condition.

5.8.1 Calling Tone

An interrupted tone transmitted from equipment with automatic calling to indicate to a person answering an incoming call that the call is from a non-speech terminal.

The calling tone shall conform to the following:

- Frequency: 1300 Hz ± 25 Hz
- Periodicity: 0.5 to 0.7 seconds ON, 1.5 to 2.0 seconds OFF

5.8.2 Answering Tone

One burst of continuous 2100 ± 15 Hz tone that is transmitted from the called equipment to the calling station to indicate that the incoming call has been answered, and that the equipment has been connected to line. The burst of tone shall be 3.3 ± 0.7 seconds in length and shall start 1.8 to 2.5 seconds after automatic answer receiving equipment has been connected to the line. During those 2.2 to 3 seconds, answering equipment shall not transmit tones or other signals to the line.

The answering equipment shall recognize the answer tone within 450 to 600 ms on the frequency 2100 ± 25 Hz.

6 EQUIPMENT WITH ANSWERING FUNCTION

6.1 GENERAL

The equipment with answering function is designed, so that after manual or automatic start, as a result of a ringing signal from the public switched telephone network, it arranges for a call to be answered. The answering function can comprise manual or automatic switching of a connection to another part of the subscriber's installation. Refer to subhead 2.5.

6.2 RINGING SIGNAL RECEPTION

In the quiescent condition, the equipment with a ringing signal receiver shall comply with the special requirements for input impedance stated in subheads 2.1 and 3.3.

In the equipment with automatic start of the answering function, the ringing signal receiver shall, when activated by a ringing signal, establish loop condition in the equipment. Such change of condition may either take place immediately or be dependent on other conditions in the equipment, for example, whether the latter is ready to answer a call.

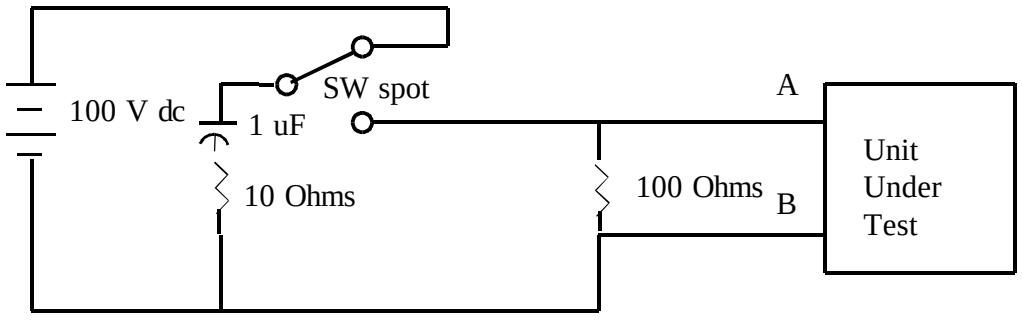
A ringing signal receiver in the equipment shall be activated 200 ms at the latest, after the time when in quiescent condition, a ringing signal made up of a dc voltage of 24 to 66 V superimposed with an ac voltage with an effective value of 25 to 120 V and a frequency of 16-2/3, 25, or 50 ± 10% Hz is applied to the line terminals of the equipment.

In the equipment with automatic start of the answering function, the ringing signal receiver shall not be activated when, in quiescent condition, the following signals are applied to the line terminals of the equipment.

- Specified ringing signals, but for periods of duration of less than 100 ms, repeated at intervals of 1 second, minimum
- Continuous signals made up of a dc voltage of 24 to 66 V superimposed with an ac voltage with an effective value of up to 10 V
- Single, stray, short noise pulses with peak voltages of up to 100 V
- Dial pulses initiated by auxiliary equipment attached or in parallel to the equipment's own ring detector

At the check made to ascertain whether the latter requirement is complied with, the measuring setup shown in Figure 18 is used.

Figure 18: Ringing Signal Reception Test Setup



In the event that the equipment with automatic start of the answering function can or shall be used in parallel with a telephone or other equipment, from which dialing can be carried

out by loop pulsing, it should not be possible for such dialing to activate the ringing signal receiver. Also, it should not be possible for it to start the answering function.

The qualities of the equipment in that respect may, with reasonable reliability, be checked by means of the measuring set-up, shown in Figure 18, in which switch K is switched on and off with frequencies from 8 to 12 Hz and a ratio of break periods of 60 or 67%.

6.3 SWITCHING-IN OF TRANSMISSION EQUIPMENT

The equipment with answering function shall switch in the transmission equipment 2 seconds at the latest, after the establishment of loop condition as a result of a ringing signal from the public switched telephone network.

If the switching-in is delayed for at least 1300 ms after the establishment of loop condition, the transmission equipment will under normal conditions be protected from ringing signal voltages.

6.4 IDENTIFICATION SIGNAL

In the equipment with automatic answering function, the automatic answering shall be started with the emission of an identification signal in the form of a code signal or a verbal announcement.

The emission of the identification signal shall be commenced within 2 seconds after the establishment of loop condition in the equipment.

6.5 DURATION OF LOOP CONDITION

In the equipment, an automatic answering of a call shall not involve loop condition for a period of more than 1.5 minutes, unless the preservation of the loop condition for more than this time is controlled by the information exchanged via the connection established.

At automatic answering of a call to the equipment in which the duration of the loop condition, in excess of 1.5 minutes, is controlled by the information exchanged, the loop condition shall be succeeded by quiescent condition 20 seconds at the latest, after the latest information has been sufficient for continued preservation of the loop condition.

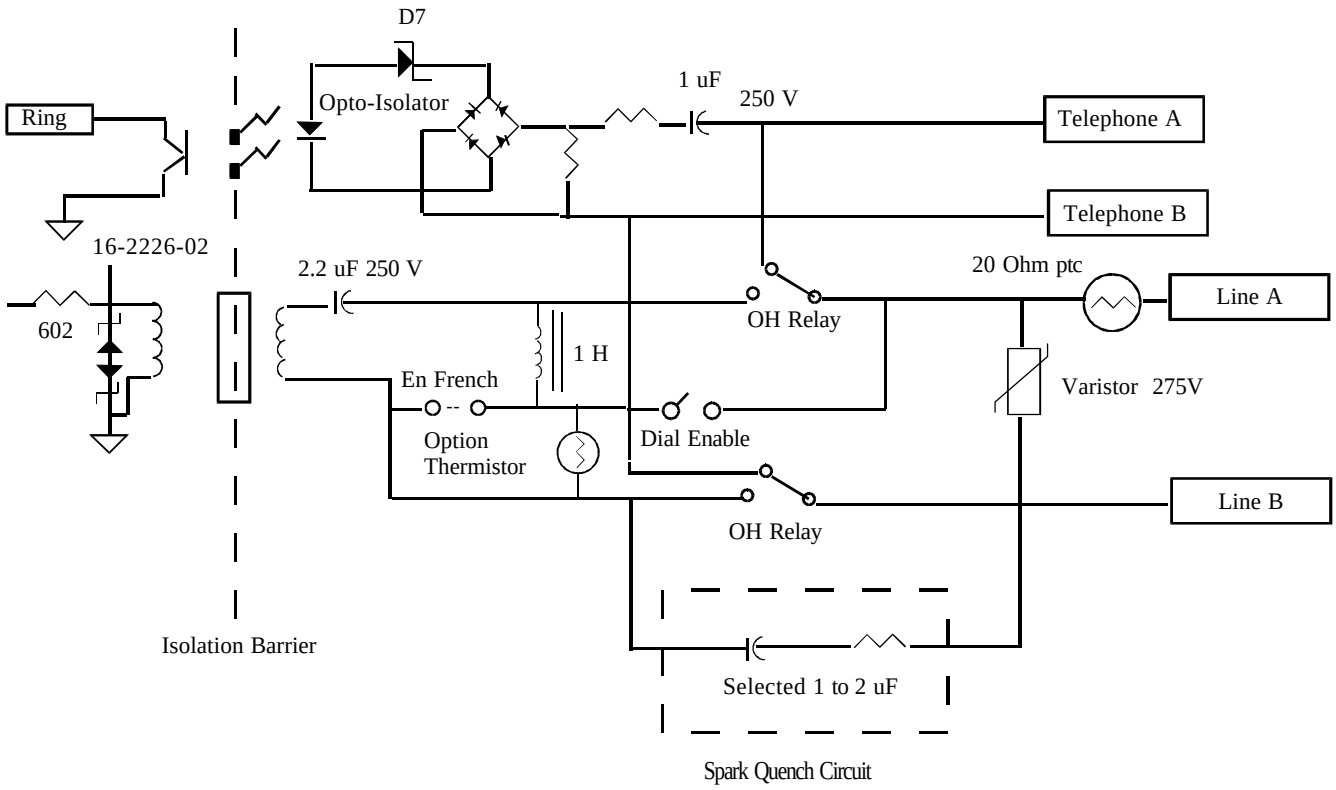
The loop condition should be maintained by speech or information signals of levels above -43 dBm. Speech levels should be measured in accordance with subhead 3.4.2. The loop must be disconnected within 10 seconds if:

- The speech or information signal level is less than -48 dBm for more than 20 seconds
- Continuous tones or tone pulses in the frequency range 340 to 500 Hz exceed a level of -30 dBm.

7 EXAMPLE OF PSTN INTERFACE

Refer to Figure 19 for an example of a telephone line basic configuration.

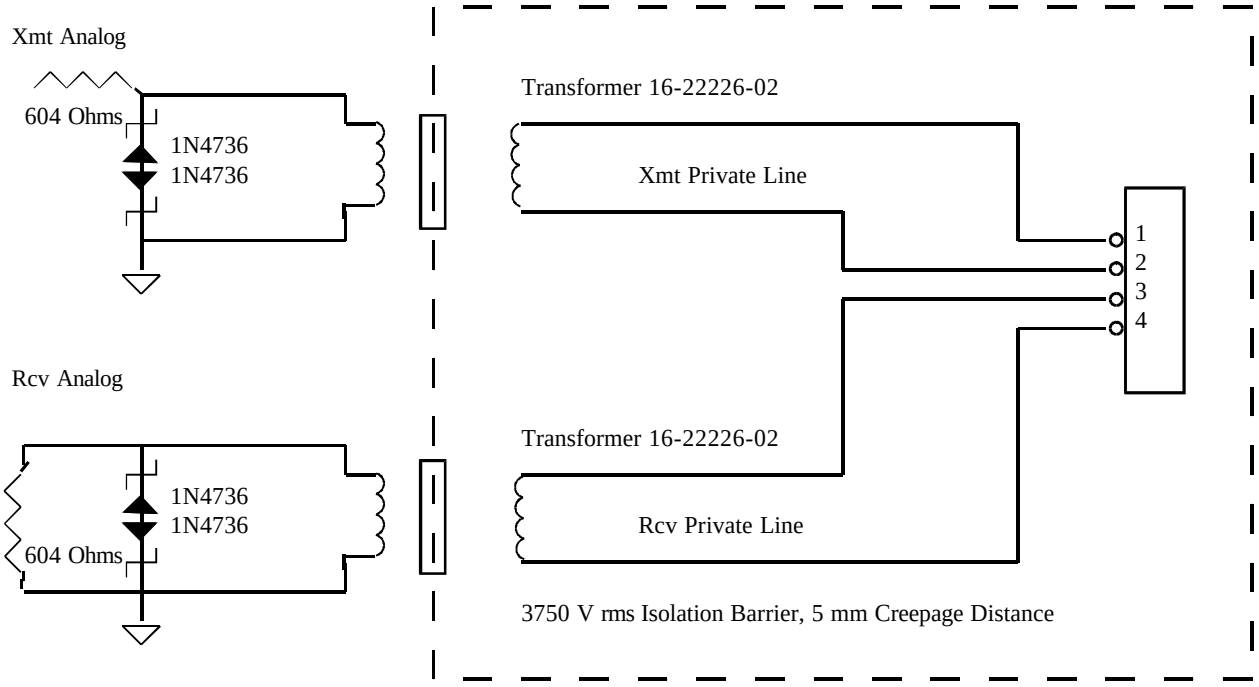
Figure 19: Telephone Line Basic Configuration



8 EXAMPLE OF LEASE LINE INTERFACE

Refer to Figure 20 for an example of the interface for attaching 4-wire lease lines.

Figure 20: Interface for Attaching to 4-Wire Lease Lines



9 AUTODIAL REQUIREMENTS BY COUNTRY

9.1 AUSTRIA

No deviations from the requirements contained in this standard have been reported at the time of issue.

9.2 BELGIUM

The following are Belgium's autodial requirements.

- Maximum 15 retries per hour.
- Minimum 120 second delay between attempts to same number.
- Maximum 80 seconds wait for response before abandonment.

9.3 DENMARK

The following are Denmark's autodial requirements.

- Minimum 1 second quiescent condition between each call.
- Maximum 10 successive unsuccessful calls before automatic alarm and blocking of further calling.
- Maximum 10 successive unsuccessful calls to same number when calling in arbitrarily recurring order before automatic alarm and blocking of further calling.

- Private equipment, which is arranged for automatic start and performance of calls, but not designed to detect whether the correct connection has been obtained shall make at the most 10 automatic calls between each manual intervention in the operation.

9.4 FINLAND

The following are Finland's autodial requirements.

- The dialing shall not start earlier than 2 seconds after the connection of the subscriber loop.
- If the equipment can identify the dial tone of the public exchange, the dialing can also start earlier.
- The identification of the dial tone must operate when the frequency of the tone is 425 $\pm$ 100 Hz, the voltage at the line terminals of the equipment is at least 45 mV (effective value), and the duration of the tone is 0.5 seconds or less.
- If the equipment is intended to be usable at an extension line of PBX and the equipment cannot identify the dial tone of the public exchange, it shall be possible to add a pause of at least 2 seconds after the first digit or signaling or it must be possible to seize the exchange line by the user.
- If the equipment automatically repeats the dialing, there must be a pause of at least 5 seconds between the first two attempts for dialing. During the pause the dc loop must be cut off. Between the following attempts for dialing, there must be a pause of at least one minute. Four attempts are allowed during an hour.
- In remote surveillance and control systems, the dialing can be different.
- If the equipment does not get the answer signal, it must be reset not later than one minute after the dialing has ended.

9.5 FRANCE

The following are France's autodial requirements.

- If a computer automatically dials a telephone number that corresponds to a person rather than to a modem, a voice message must be sent to the person to explain the situation and the number must be deleted from the list of numbers that the computer can call automatically.
- This is usually done by associating a cassette tape recorder to the autodialer.
- This type of arrangement is used in European Technical Centre in Valbonne, France.
- Dial tone must be detected.
- Recall after failed attempt allowed if: line is left free between consecutive attempts; minimum 120 seconds between attempts to the same number; maximum five attempts to the same number in 60 minute period; maximum 2 minute delay before cleardown if no reply received from polarity inversion or charging pulse detection.
- If expected tone not received in a reasonable time, no further auto calls until after human intervention.

9.6 GERMANY

The following are Germany's autodial requirements.

- On PSTN, V.25 has been made into the test specification and a simulation program has been written.
- PSTN (FTZ 18R1, section 12.3 and FTZ 18R4, section 9)
- A maximum of 12 attempts is allowed.
- Delay of one minute between each series of 12 attempts.

The following are data network requirements.

- Connection to X.21 bis.
- Maximum of eight attempts.
- 30 seconds between batches. No timing requirement between attempts.

9.7 IRELAND

No deviations from the requirements contained in this standard have been reported at the time of issue.

9.8 ITALY

No deviations from the requirements contained in this standard have been reported at the time of issue.

9.9 JAPAN

The following are Japan's autodial requirements.

- Maximum two retries per 10 minutes. Retries shall be within two times and further retries shall wait for minimum 10 minutes.
- In the case of no dial tone detection, more than 3 seconds delay from off-hook is required to start dialing.
- It is recommended to detect the polarity of the line to prevent the conflict of in-coming call and out-going call and to detect the distant party connected.
- Line must be released within 50 seconds from end of dialing signals, if there is no response from called party.

9.10 NETHERLANDS

The following are the Netherlands' autodial requirements.

- Maximum of 10 calls per message.
- Dial tone must be detected before start of dialing.
- Second dial tone must be detected before completion of dialing of international calls.
- Waiting time for dial tone not more than 40 seconds.

- Line to be released if no dial tone detected.
- Minimum 5 seconds before start of new call if no dial tone detected on previous attempt.
- Maximum three re-dial attempts at same number.

9.11 NORWAY

The following are Norway's autodial requirements.

- Must be able to store at least 15 digits.
- Must be indicator indicating operation.
- Must have dial tone receiver.
- Line to be released if no dial tone in 20 seconds; next call attempt must be initiated manually.
- Auto dialers with built in monitoring loudspeaker may automatically repeat call if subscriber busy.
- The line must be disconnected for minimum of 5 seconds between the first and second attempt.
- Between each subsequent attempt the interval must be at least 60 seconds.
- Maximum number of attempts is five.
- If telephone set used during automatic repetition sequence, then sequence must be canceled.
- Once the handset is lifted from telephone set cradle or maximum of 60 seconds after dialing is completed the telephone set should be reconnected to line and any built in monitoring loudspeaker disconnected.
- Loudspeaker can be reconnected by manual intervention.

9.12 SWEDEN

The following are Sweden's autodial requirements.

- Must have dial tone receiver.
- Maximum repeat call attempts = 10.
- Minimum 60 seconds between attempts except for alarm equipment; here the delay is 3 seconds.
- Equipment shall be disconnected after a maximum of 3 minutes or 1 minute if occupancy time is automatically controlled.
- Minimum of 3 seconds between calls when different numbers called in sequence.
- CCITT interchange circuit 107 (modem ready) must be OFF in the automatic dialer and remain OFF until the dialer passes control to the modem.

9.13 SWITZERLAND

The following are Switzerland's autodial requirements.

- Maximum 120 seconds without signal detection before cleardown.
- 10 seconds between calls if busy received.

9.14 UNITED KINGDOM

The following are the United Kingdom's autodial requirements.

- Instructions must state that it is not to be used for calls to the Emergency Services (999 calls) in the case of equipment capable of giving voice alerts.
- Dial tone must be detected within 3.5 seconds

  and either

  — First digit must be sent within 8 seconds of on-line status being established; or

  — Clear down within 10 seconds of the on-line state being established.

  — Time out should be less than one minute for ineffective outcomes other than those in Table 1.

The following are requirements for one or two repeat attempts.

1. No more than four repeat attempts to the same number in 4 hours after failure of the first attempt.

   Must wait at least 5 seconds between initial attempt and a second attempt.

   Must wait at least 1 minute between second and third attempt.

   Must wait at least 2 minutes between third and fourth attempt.

   Must wait at least 2 minutes between fourth and fifth attempt.

   NOTE

   Cycle can be repeated. Forty-eight minutes should be left between last attempt of old and first of new.

   Times are measured from cleardown to re-seizure.

2. No more than three repeat attempts to the same number after failure of the first attempt.

   Must wait at least 1 minute between the initial attempt and a second attempt.

   Must wait at least 1 minute between second and third attempt.

   Must wait at least 1 minute between third and fourth attempt.

   NOTE

   If all attempts are unsuccessful, the apparatus should alert the user to make a check of the called number.

10 COUNTRY-SPECIFIC INFORMATION AND VARIANCES

10.1 AUSTRALIA

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.2 AUSTRIA

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.3 BELGIUM

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.4 DENMARK

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.5 FINLAND

According to the Act relating to telecommunications in Finland, terminal equipment shall be type approved before it can be connected to a public telecommunications network. The main points of the procedure for type approval follow.

1. Terminal equipment shall meet the requirements confirmed by the Ministry of Communications before the type approval can be given.
2. The type approval is given by the Electrical Inspectorate (SETI) of Finland. The validity of approval is 5 years.
3. A request for approval will be considered from any person or body legally established in Finland.
4. The tests for the type approval are made by the Telecommunications Laboratories of Posts and Telecommunications in Finland for all equipment, or by the Research Institute of the Helsinki Telephone Company.
5. The application drawn up on an application form shall be delivered with the equipment to the test laboratory. Usually two pieces of the equipment are needed in the test, except for telephones of which five pieces are required. In special cases, one piece is sufficient.
6. The relevant parts of the following documents shall be submitted to the test laboratory with the equipment.
   - Technical characteristics
   - Directions for use and installation
   - Circuit diagrams and component lists concerning the interface to telephone network
   - Description of functions
   - Description of system
   - Necessary documents of software

- List of standards according to which the equipment is designed
- Information about other approvals of the equipment
- Any other information which the relevant standards specify.

7. The language of the application and other documents shall normally be Finnish, but also Swedish and English are permitted. In special cases, other language can be used. Documents submitted for the approval will be treated confidentially.
8. Fees are FIM 225 per hour for testing and FIM 625 for approval. The bill is sent to the applicant after the tests. In special cases, prepayment is required.
9. If the equipment employs radio transmissions, the applicant shall also deliver the equipment to the Radio Laboratory of Posts and Telecommunications for the tests of radio transmissions.
10. According to the Finnish Electricity Act, some equipment is subject to compulsory advance testing for electrical safety. Such equipment must be delivered to SETI for an electrical safety test.
11. The validity of the approval may be canceled if the equipment from the sample for which the approval was originally granted in a way that could affect compliance with the approval requirements of if changes in the telecommunications network affect the approval requirements.
12. The decision on type approval can be appealed to the Ministry of Communications in writing within 60 days from the decision.
13. A list of terminal equipment approved is maintained in SETI.

The following are Finnish regulatory agencies and their addresses.

- Ministry of Communications
  Division for Inspection of Telecommunications
  Pälkäneentie 12
  P.O.B. 526
  SF-00101 Helsinki
  Finland
  Telephone +358 0 7041
- Telecommunications Laboratories of Posts and Telecommunications
  Kiviadankatu 2 F
  P.O.B. 64
  SF-00211 Helsinki
  Finland
  Telephone +358 0 692 11
- Research Institute of Helsinki Telephone Company
  Kutomontie 14
  SF-00380 Helsinki
  Finland
  Telephone +358 0 6061

- Radio Laboratory of Posts and Telecommunications
  Särkiniementie 5
  P.O.B. 15
  SF-00211 Helsinki
  Finland
  Telephone +358 0 696 61
- Electrical Inspectorate (SETI)
  Särkiniementie 5
  P.O.B 21
  SF-00211 Helsinki
  Finland
  Telephone +358 0 696 31

10.6 FRANCE

The French administration requires current limiting to be incorporated in the interface in form of a thermistor. Figure 19 shows that implementation.

No other deviations from the requirements contained in this standard have been reported at the time of issue.

10.7 GERMANY

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.8 HOLLAND

Table 10 is a review of the most important tones that can occur in the Dutch telephone network.

Table 10: Important Tones in the Dutch Telephone Network

Meaning	Tone Sequence		Basic Frequency	Transmission
	Tone (ms)	Pause (ms)	(Hz)	Level (dBm)
First dial tone	continuous	none	150 ± 10	-6 ± 6
Second dial tone	continuous	none	425 ± 15	-11 ± 4
Engaged tone	500 ± 50	500 ± 50	425 ± 15	-11 +2/-4
Congestion tone	250 ± 25	250 ± 25	425 ± 15	-11 +2/-4
Ringing tone	1000 ± 250	4000 ± 500	425 ± 15	-11 +2/-4
PBX dial tone	continuous	none	425 ± 15	-11 +2/-4
Unobtainable (PBX)	62.5 ± 6	62.5 ± 6	425 ± 15	-11 +2/-4
Call waiting (PBX)	250 ± 25	4750 ± 500	425 ± 15	-11 +2/-4
Listen in tone (PBX)	2 to 4 periods	500 ± 50	425 ± 15	-6 ± 3
Information tone	330 ± 70		950 ± 50	

Table 10 (Cont.): Important Tones in the Dutch Telephone Network

Meaning	Tone Sequence		Basic Frequency	Transmission
	Tone (ms)	Pause (ms)	(Hz)	Level (dBm)
	330 ± 70	1000 ± 250	1400 ± 50	-14 +2/-4
	330 ± 70		1800 ± 50	
Screech tone	250 ± 50	none	2000 ± 50	6 ± 1.5
	250 ± 50	none	2600 ± 50	6 ± 1.5

The PTT does not vouch for the signal tone frequencies, sequences, and distortions. Allowance should be made for the fact that in practice the tones given in Table 10 will not always be sinusoidal and that their nature will in many cases be determined by higher harmonics. The third harmonic of 425/445 Hz can occur up to a level only 3 dB below that of the basic tone.

10.8.1 Tone Detector

The dial tone detector meets the requirements with regard to dial tone detection if an alternating voltage from 80 mV to 1.8 V, with a frequency between 100 Hz and 550 Hz, is recognized as such at a minimum of 1 second and a maximum of 2 seconds after application of this voltage to the dial tone detector. The voltage is transmitted from 600 or 800 ohms.

The dial tone detector must not interpret any other tone sequences as dial tones. This requirement is met if the dial tone detector does not initiate dialing by the equipment in the case of a voltage from 80 mV to 1 V with a frequency varying continuously between 340 and 550 Hz and is offered to the tone detector according to the following sequences.

- 180 ms tone - 330 ms pause
- 330 ms tone - 180 ms pause
- 405 ms tone - 605 ms pause
- 605 ms tone - 405 ms pause

The dial tone detector must not be sensitive to noise present in the telephone line. This requirement is met if the detector does not react to an alternating voltage of 40 mV, transmitted from 600 or 800 ohms. This requirement applies to all frequencies.

10.8.2 Spark Quenching Circuit

To obtain the correct pulse form and to prevent undesirable voltage peaks, a spark-quenching circuit or RC filter should be fitted in parallel with the pulse (break) switching element, and should consist of a resistance with a nominal value of 560 ohm and a capacitor with a nominal value of 1 µF at a specified nominal operating voltage of at least 250 V, connected in series. Refer to Figure 10. The nominal ignition or flashover voltage of any overvoltage release present during dialing must not be less than 100 V. The direct current resistance permitted during dialing should lie between the limits indicated.

10.8.2.1 Transmission Level of DTMF Tones

The transmission level on closing with 600 ohm should be:

- For each frequency from the low group: -11 ± 2 dBm
- For each frequency from the high group: - 9 ± 2 dBm

In each dialing signal, the level of the frequency from the high group should be 2 ± 1 dB stronger than that of the frequency from the low group.

The signal duration, which is the time during which the transmit condition is stable, should be between 65 ms and 125 ms. The period duration, which is the sum of signal duration, transition, and pause, should be at least equal to twice the signal duration and should not be greater than 250 ms.

Both during transmission of the dialing information and during the transitions the line current must not be interrupted or fall below 16 mA.

The transition states between transmission and non-transmission and vice versa, during which the signal is unstable, must not last longer than 7 ms.

The total distortion is defined here as being the total of all harmonics and intermodulation products, summed on a power basis. The total distortion should at all times be at least 20 dB weaker than the level of the frequency from the low group.

Both during transmission of dialing information and in the transition states between transmission and non-transmission, no interference signals may be transmitted with a level higher than:

- -33 dBm in the frequency band from 300 to 5000 Hz;
- Indicated in Td 280-1 above 5000 Hz. When no tone code signal is being transmitted, no interference signals may be generated with a level higher than -80 dBm.

10.8.2.2 Automatic Re-dialing

The provisions given below in respect of automatic re-dialing apply only to equipment for alarm, telecommunication, and data transmission. These requirements, therefore, correspond with the information given in specification Htf 02-28. For the requirements set for semi-automatic dialing equipment (desk dialers) and call-switching equipment (call diverters), refer to the corresponding specifications Htf 02-19 and Htf 02-104.

Automatic re-dialing is permitted in the following cases:

- No dial tone within 40 seconds after seizing the line
- Congestion tone or absence of further dialing tones during dialing
- Engaged or information tone after dialing

For a review of the above tones, refer to subhead 10.8.2.1 of this specification.

Automatic re-dialing is defined here as the series of operations with a fixed sequence and automatically initiated, as given below:

- Break
- Wait for at least 5 seconds
- Seize line

- Re-dial

Not more than 10 consecutive dialing attempts may be made in the situations indicated. Thereafter, there must be a waiting period of at least one hour.

10.8.2.3 Connection

The equipment must be connected in such a way that, during checking of the PTT equipment present, including the telephone line, it can be easily isolated from the telephone line. The connection should be such that, when the equipment is removed, what remains is a normal telephone connection.

The terminals for the telephone line wires should be marked with the letters *a* and *b*.

The equipment should be fitted with a PTT-approved connecting cord and 4-pin PTT plug for connection to a PTT wall-socket outlet. The connecting cord terminating at the 4-pin plug must conform to drawing Htf 87 G 1308 D. The 4-pin plug must conform to drawing Htf 87 G 4113 C and the socket outlet must conform to drawing Htf 87 G 4114 C.

This connecting material is available from: PTT, Directoraat Materieelvoorziening Postbox 30 000 2500 Ga 'S Gravenhage

10.9 IRELAND

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.10 ITALY

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.11 NORWAY

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.12 SWEDEN

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.13 SWITZERLAND

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.14 HONG KONG

No deviations from the requirements contained in this standard have been reported at the time of issue.

10.15 JAPAN

In addition to technical requirements, Japan requires submission of a manufacturing quality test plan for Japanese administration to review. Measured data and how the data was measured are required with equipment used.

The terminal equipment shall not cause the line to oscillate.

The following Japanese requirements shall be considered.

- Allowed transmission level
  - — Up to 4 KHz P = (-15 + L) dBm; where L is the line loss from 0 to 7
  - — 4 to 8 KHz: less than or equal to (P-20) dBm
  - — 8 to 12 KHz: less than (P-40) dBm
  - — Above 12 KHz for each 4KHz bandwide: (P-60) dBm

  All transmission levels are the measured value with termination of 600 ohms and no externally added current.
- Busy tone
  - — 400 Hz
  - — ON 0.5 seconds ± 10%
  - — One cycle = 1 second ± 20% greater than or equal to -29 dBm and less than or equal to -4 dBm
- Call progress tone
  - — 400 Hz modulated by 15 to 20 Hz frequency with a modulation ration of 85 ± 15%
  - — ON 1 second ± 10%
  - — One cycle = 3 seconds ± 20% greater than or equal to -29 dBm or equal to -4 dBm

10.16 UNITED KINGDOM

10.16.1 General

The United Kingdom requires component verification and certification as well as certification of safety of power supply. The power supply must be submitted for testing against BS 6301 safety standard. The designer must provide all safety critical components for evaluation and certification. It is important for a designer to use already approved components and, therefore, shorten the approval cycle. The following parts have been approved by BABT and valid certification is maintained.

- Isolation audio transformer: Digital part number 19-22226-02
- Opto-isolator: Digital part number 19-21337-02
- Relays: Digital part numbers 12-22385-01, 12-22386-01, 12-22387-01, and 12-22383-01

10.16.2 Physical Network Connection Methods

The primary method of connection is to jack sockets. The associated plug is specified in BS 6312: 1982.

There are alternative methods of connection, for example, for multiline installations such methods may include terminal blocks or termination frames.

Apparatus entirely or primarily concerned with data transmission or dedicated to multistation or multiline layouts supervised by a call-connect system or a cluster controller may use 2-wire connection.

10.16.3 Electrical Characteristics of the Network

This subhead describes the nature of the direct and alternating voltages presented by the network in normal operation. BT does not guarantee that deviations will not occur. Calls routed outside the BT national network may encounter tones and announcements with different characteristics. BT has reserved its right to enhance, improve, or otherwise change or modify its network.

10.16.3.1 Exchange Line Voltage

Open-circuit voltage and line-current feeding.

Exchange batteries have limits in the range of 44 to 52 V. In the long term, these limits will become 40 to 57 V. The positive pole is earthed. Ripple components up to 2 mV psophometric may be present. Adaptive line-feed circuits may connect up to 70 V to the line in the future. Depending on line resistance, currents as low as 25 mA are allowed.

Step changes in the open-circuit voltage may occur within the limits stated.

Modern designs of exchange will give an essentially constant current line feed with a nominal value of 40 mA. However, when the total loop resistance is high, the feeding circuit becomes essentially constant voltage. Under certain conditions, such as line parked, the current may be reduced to a low value, even with off-hook conditions presented.

10.16.3.2 Exclusive Lines

Normal conditions are negative battery: relative to earth, on the B-wire; and earth, on the A-wire. These conditions are subject to reversal.

10.16.3.3 Positive Battery

Pulses of 50 V potential, positive with respect to earth, may occur on the line. Simultaneous disconnection of the other wire may also occur, the conditions lasting up to 300 ms.

10.16.3.4 Voltage Transients

Change of line conditions, for example, polarity, voltage, speechband level, feeding resistance, and current interruptions, may occur during processing of a call by the network.

10.16.3.5 Standard Supervisory Tones

Where tolerances are given, these may be considered as worst case conditions, and should not be taken as design tolerances. Refer to Table 11.

Table 11: Important Tones in the UK Telephone Network

	Frequency[1]	Cadence[2]	Range of Levels Received at Customer's Termination	Notes
Proceed indication	33 or 50 Hz	continuous	0 to -27 dBm	Will be in widespread use for several years; rich in harmonics.
New proceed indication	350 Hz ± 5%, plus 440 Hz ± 5%	continuous	0 to -27 dBm; each tone 3 dB lower	Use will continue to increase during the next several years.
Special proceed indication	350 Hz ± 5%, plus 440 Hz ± 5%	440 Hz continuous; 350 Hz pulsed; 750 ms on; 750 ms off	0 to -27 dBm; each tone 3 dB lower	May be used in place of normal dial tone to notify users of activation of supplementary services.
Special information tone	950 ± 50 Hz; 1400 ± 50 Hz; 1800 ± 50 Hz; Each frequency sent for 330 ± 70 ms in the order given and with silent periods of up to 30 ms between adjacent signals.	For inland purposes to indicate that a reference to an operator should be made if it is not understood.		
Echo-suppressor	2100 ± 20 Hz	To persist for a minimum of 400 ms	For international data calls, but may in future be needed also on inland data calls.	
Number engaged indication	400 Hz	0.375 s on/off	0 to -37 dBm	Certain PBXs have different cadence. Busy tone may be presented on disconnected TXE2 lines.
Path engaged indication	400 Hz	0.4 s on, 0.35 s off; 0.225 s on, 0.525 s off	-6 to -43 dBm; 0 to -37 dBm	The shorter tone is 6 dB higher than the longer tone.
Connection not admitted indication	400 Hz	continuous	0 to -37 dBm	
Park tone	400 Hz	0.4 s on, 0.35 s off; 0.225 s on, 0.525 s off	-6 to -43 dBm; 0 to -37 dBm	The shorter tone is 6 dB higher than the longer tone.

[1] 1 ± 20%, except where stated

[2] 1 ± 25%, except where stated

Table 11 (Cont.): Important Tones in the UK Telephone Network

	Frequency[1]	Cadence[2]	Range of Levels Received at Customer's Termination	Notes
Pay tone	400 Hz	0.125 s on/off; starts with called station answer and continuous for 11 to 13 s or until money is inserted.	0 to -37 dBm	Received only on calls from pay-on-answer pay phones. These are to be replaced by new, pre-payment phones during the next few years.
Pay phone identification tone	800 Hz ± 2.5%; 1200 Hz ± 2.5%	125 ms ± 10% on, 1.5 s off. Starts at end of dialing 100 and continues throughout the call.	-15.5 to -52.5 dBm	Sent by distant customer's apparatus and received only on calls made via the operator from new pay phones.
Awaiting answer indication	400 or 450 Hz modulated by 50, 25, or 17 Hz	0.4 s on, 0.2 s off; 0.4 s on, 2 s off	0 to -37 dBm	Cadence does not necessarily coincide with ringing current cadence.
	400 Hz plus 450 Hz at approximately the same level	0.35 s on, 0.22 s off then start at any point in: 0.4 s on, 0.2 s off; 0.4 s on, 2 s off	0 to -37 dBm	
3 minute timing pips - manual trunk calls	900 ± 30 Hz	3 periods of 0.15 s tone separated by 0.85 s		The provision of this signal will cease with modification of the network.
Recording warn tone	144 ± 21 Hz	350 to 500 ms pulse every 15 ± 3 s	-6 to -43 dBm	Sent by distant customer's apparatus.

[1] 1 ± 20%, except where stated

[2] 1 ± 25%, except where stated

10.16.3.6 Call Arrival Indication (Ringing)

Refer to Table 12.

Table 12: Call Arrival Indication (Ringing)

Frequency (+5% -13%)	Cadence (+10% -20%)	Range of Voltages Generated at Exchange	Notes
16 2/3 Hz	0.4 seconds on	63 V to 100 V rms	Cadence does not necessarily coincide with ring tone cadence.
	0.2 seconds off		
	0.4 seconds on		
	2 seconds off		
or			

Table 12 (Cont.): Call Arrival Indication (Ringing)

Frequency (+5% -13%)	Cadence (+10% -20%)	Range of Voltages Generated at Exchange	Notes
25 Hz +1 Hz -5 Hz	0.35 seconds on	63 V to 100 V rms	Some exchanges provide a facility known as immediate ring. In these cases, an initial burst of ringing, 20 ms to 1 second, immediately precedes switching to any point in the normal ringing cycle.
	0.22 seconds off then start at any point in: 0.4 seconds on 0.2 seconds off 0.4 seconds on 2 seconds off		

10.16.3.7 Howler

Refer to Table 13.

Table 13: Howler

Frequency	Cadence	Range of Levels Received at Customer's Termination	Notes
Multi-audio Frequency	Continuous for 3 minutes or until line release, if this occurs first.	Applied initially at mean power level of up to -8 dBm, rising over 12 seconds to +15 dBm; +20 dBm total maximum power.	To draw attention to a telephone left online. May be applied to attachments that hold after the distant end has cleared or after an unsuccessful call.

10.16.3.8 Verbal Announcements (VA)

VAs may be connected at various stages of calls via system X. Examples are: *Sorry for the delay. Please wait for dial tone before dialing; Sorry there is no reply; Sorry your call cannot be connected, please try again*. Announcements may be transmitted from one to five times.

VAs may be preceded by special information tone as described in Table 13. The mean level of VAs received at customer's terminations is in the range -14 to -28 dBm.

10.16.3.9 Meter Pulses

A private meter pulse is a 50 Hz signal applied longitudinally; that is, to the A and B wires in parallel as a single conductor. The usual method of detection at a calling station is a capacitor in series with a center-tapped coil. In series with a second capacitor, this combination being connected across the A and B wires. The signal at the center-tap is detected with respect to earth.

The voltage of the pulse at the exchange is in the range 40 to 45 V rms and the current available at the calling station is approximately 1 mA rms. The signal is likely to be rich in harmonics. The duration of the pulse at the exchange is in the range 200 to 595 ms, but regenerative distortion can elongate pulses to durations in excess of 1 second at the customer's terminal.

Meter pulses are normally provided only by special arrangement between BT and the user, but may be present whether or not the supply of them has been requested.

10.16.3.10 Noise, Induced Voltages and Line Surges

- Permanent longitudinal direct voltages up to 4 V may exist on the line.
- Permanent longitudinal alternating voltages up to 5 V rms 50 Hz, and associated harmonics, may exist on the line. Additionally there may be an earth potential difference up to 3 V rms 50 Hz.
- Permanent longitudinal and transverse alternating voltages, which generally do not exceed 3 V rms, at other frequencies up to 2 MHz may exist on the line. These are generally noise voltages, but between 200 kHz and 2 MHz they may be amplitude modulated and be as a result of radio broadcast signals.
- Uniform spectrum and random noise having a power of -42 dBm in the frequency range 300 to 3400 Hz may exist on the line, with random impulsive noise in excess of -22 dBm. Also, other types of random transmission impairment may occur, such as interruptions, phase changes, phase jitter, and gain changes.

10.16.3.11 Distribution of Insertion Loss

Refer to Figure 18.

10.16.3.12 Distribution of Relative Group Delay

Refer to Figure 19.

10.16.3.13 Routing Digits

The maximum numbers of digits required to route national and international calls through the PSTN are:

- For national calls: 11
- For international calls: 18

NOTE

The number for national calls may ultimately be increased to 12, but such an increase is unlikely to take place for many years.

10.16.3.14 Ring Trip

In normal operation ringing current may be applied for typically 110 ms to 510 ms after the on-line state is established.

10.16.4 Ringer Equivalence Number and Ringing Detector Characteristics

10.16.4.1 Determination of REN

10.16.4.1.1

The apparatus is connected, for 2-wire connected devices, between terminals A and B or, for 3-wire connected devices, between terminals A, B and shunt in the test circuit shown in Figure 20. The BT Bell 59D in Figure 20 is one that generates a sound pressure of not less than 65 dB (A weighted) SPL when measured at a distance of 1 m when connected in the test circuit of Figure 20 with three other 59D bells connected across the shunt and A terminals, and acoustically isolated, and that forms the ring detector of a BT telephone No. 8746. Where either the BT Bell No. 59D or the apparatus ringing detector fails to function as specified in the relevant product standard, no REN is assigned to the apparatus.

Where the BT Bell No. 59D and apparatus ringing detector function correctly as specified in the relevant product standard, the procedure for determination of REN is continued as described in this subhead or subhead 10.15.4.1.2 as appropriate.

10.16.4.1.2

For apparatus other than that described in 10.15.4.1.3, and where in the configuration described in 10.15.4.1.1 the BT Bell No. 59D and apparatus ringing detector function correctly as specified in the relevant product standard, additional complete items of apparatus similar to the original apparatus are then connected in parallel with the original apparatus. The number of added items of apparatus is increased until either one of the following occurs:

- Any ringing detector including the BT Bell No. 59D fails to function as specified in the relevant product standard
- The total number of items of apparatus connected equals the exact value stated by the supplier to be the maximum number of items of apparatus that should be connected simultaneously to the line
- Ten items of apparatus are connected

The REN value of the apparatus is calculated from the expression: REN = 3/n, where n is either of the following, whichever is the smallest number:

- The maximum number of items of apparatus connected for which all ringing detectors including the BT Bell No. 59D function correctly as specified in the relevant product standard
- The value stated by the supplier to be the maximum number of items of apparatus that should be connected simultaneously to the line
- Ten items of apparatus are connected

10.16.4.1.3

For apparatus that is not capable of forming part of a multiple installation and that is suitable, where a BT instrument has to be provided, only as the sole additional termination of the line, and where in the configuration described in 10.15.4.1.1 the BT Bell No. 59D and apparatus ringing detector function correctly as specified in the relevant product standard, a REN of value three is assigned to the apparatus.

Typical ringing detector characteristics. BT ringing detector types in common use include mechanical and electronic assemblies. They are characterized as follows:

- Type 59D: Dual-coil, total dc resistance, 4 Kohms + 15 % -5% at 20 degrees C. When excited at 25 Hz, approximate equivalent circuit of 7500 ohms in series with 60 H.
- Type 79D: single-coil, dc resistance as type 59D. When excited at 25 Hz, approximate equivalent circuit of 9500 ohms in series with 80 H.
- Electronic: Minimum impedance of approximately 8 Kohms, turn-on voltage of between 7 and 10 V dc.

11 LABELING REQUIREMENTS

The labeling requirements are not covered by this standard. Please refer to DEC STD 178 (all sections) for more information.

12 CABLES AND ADAPTERS REQUIRED TO CONNECT TO PSTN

Refer to EL-EN210-00, *Technical Bulletin Telephone Adapter Cables*.

APPENDIX A

SURGE TESTING

A.1 SURGE TESTING

(Digital) No damage shall occur when the equipment line terminals are subjected to the following conditions:

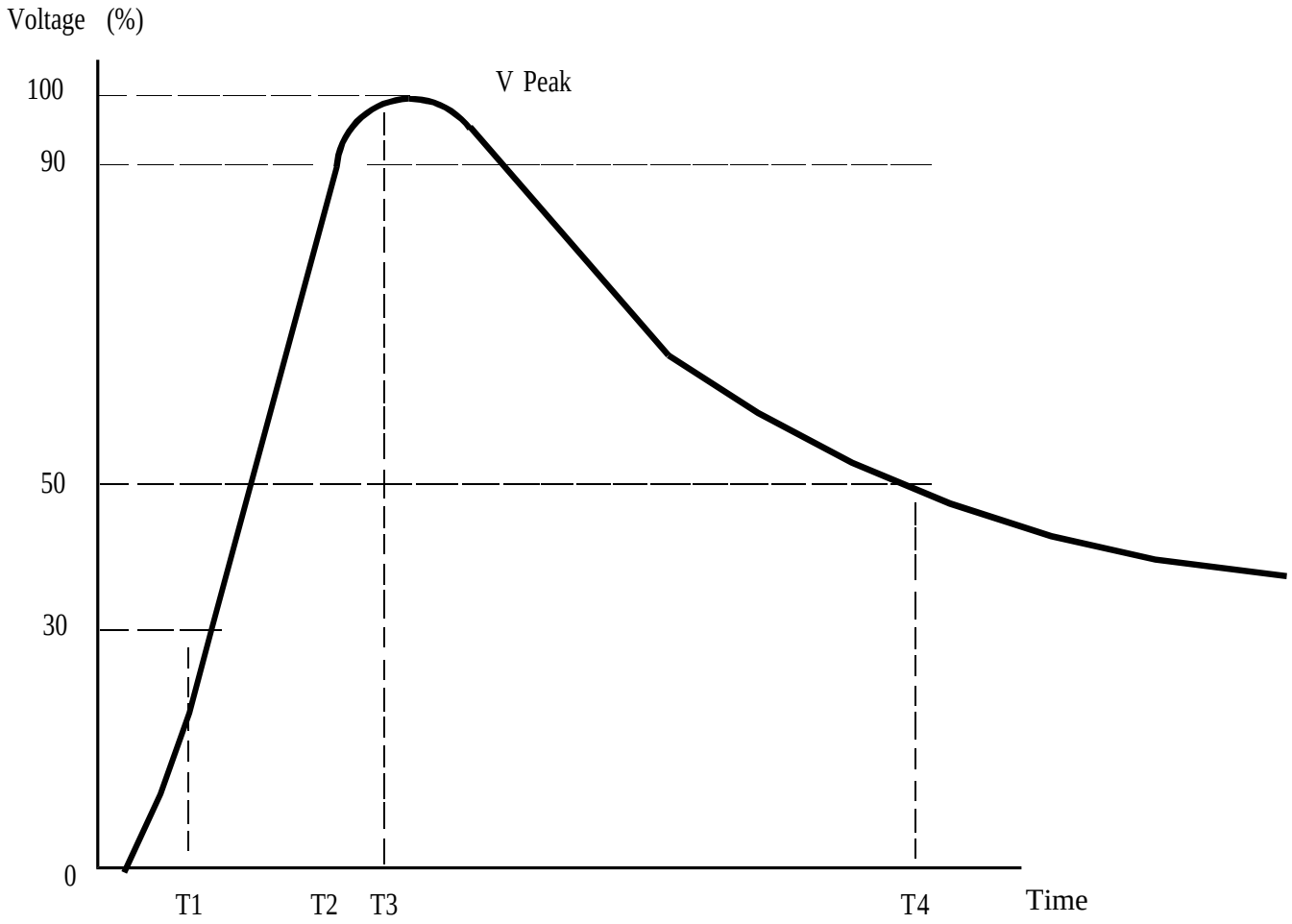
a. With the equipment in use or on-hook, the a-wire and b-wire of the transmit and receive pairs (if separate) shall not be damaged by a pulse with

T1 = 10 microseconds
Tp = (T4 - T1) = 1000 microseconds using the definitions in Figure 21
V peak = 2000 V (no load)
I avail = 200 A (short circuit)

b. With the a-wire and b-wire shorted together, the equipment shall not be damaged by a pulse between the shorted wires and ground with the same parameters as in item a.

The tests in items a and b shall be carried out for a total of 20 pulses for each condition applied at 10 second intervals. Refer to Figure 21.

Figure 21: Test Wave Form



T1 - the intercept of the axis with a line drawn through the 30% and 90% points of the rising part of the wave form

T3 - the intercept of the 100% line with a line drawn through the 30% and 90% points of the rising part of the wave form.

A.2 HEATING OF COMPONENTS

The apparatus is operated with its power, if any, connected, but with the apparatus not connected to a communications line. Test voltages are applied to any parts of the apparatus that are designed to be conductively connected to the a and b wires of the communications line, as follows:

a. The following test voltages are applied in turn between the a wire and b wire;

1. 60 V dc through a series resistor of 300 ohms;

2. 100 V dc maximum, current-limited to 50 mA.

b. If the apparatus has an earth connection, the test voltages stated in items a1 and a2 are applied in turn between the a wire and earth ground and then between the b wire and earth ground.

c. With the apparatus in the off-line no-signaling condition, 100 V ac at the frequency and cadence stated for the call arrival (ringing) given in the second item of clause C.3 of BS 6305: 1982 is applied on one wire, while 60 V dc through a series resistor of 600 ohms is applied to the other wire.

NOTE

The test described in item c applies only to apparatus intended for connection to the PSTN.

During the tests, the temperature of any component in the apparatus that is likely to dissipate heat generated by the application of the test voltages is measured when conditions have stabilized. Any conditions that may affect the results (for example, the position of line relays or telephone hook-switches) should be in the most unfavorable state.

APPENDIX B

RELATED DOCUMENTS

B.1 AUSTRIA NATIONAL REQUIREMENTS

B.1.1 General Information

Ddh I 0004, *Verzeichnis der gultigen Vorschriften und Behelfe fur den fernmeldetechnishcen Dienst*

Ddh I 0005, *Richtlinien fur die Einreichung zur Zulassung (Genehmigung) von privaten Zusatzeinrichtungen und Privatfernmeldeanlagen (ausgenommen Nebenstellenanlagen, sowie deren Erganzungsausstattungen) und deren Anschliessung an das Leitungsnetz der PTV*

B.1.2 National Regulations

Overview Statement by Telecom Australia, 8/8/83

Authorization Application Form

Specification 1037 Issue 1, *Acoustic Coupling on PSTN*

Specification 1050 Issue 2, *Attachment of Private Equipment to Telecommunications Network (General Conditions)*

Specification 1053 Issue 3, *Attachment of Private Equipment to Telecommunications Network*

Specification 1054 Issue 3, *Attachment of Private Equipment to Privately-Leased Lines*

Specification 1222 Issue 2, *Use of 604/611 Plug and Socket*

Specification 1240 Issue 1, *Attachment of Private Data Modems to Telecommunications Network*

Specification 1255 Issue 1, *Automatic Calling Equipment for Association with Permitted Attachments Connected to PSTN*

Specification 1302 Issue 1, *Electrical Safety Requirements for Permitted Attachments*

Specification 1364 Issue 1, *Line Isolation*

B.1.3 Telex and Data Terminal Equipment

Ddh II 0055, *Telex-Nebenstellenanlagen*

Ddh II 0063, *Pflichtenheft fur Bildschirmtextendgerate der Teilnehmertype 1-A* (CEPT Standard)

B.1.4 PSTN Terminals and Additional Equipment

Ddh III 0166, *Technische Bestimmungen fur Nebenstellenanlagen*

Ddh III 0168, *Pflichtenheft fur den Tastwahlblock W 80 (IWV und MFV)*

Ddh III 0171, *Ubertragungs und wahltechnische Bedingungen fur das 12 kHz-Gebunrenimpulsubertragun*

FZA-Mz 4029, *Prufprotokoll fur private Zusatzeinrichtungen (Rufnummerngeber, Alarm u. Notrufeinrichtungen udgl.)*

Ddh IV 0029, *Ubertragungstechnische Bedingungen fur Nebenstellenanlagen*

Ddh IV 0031, *Technische Bestimmungen fur automatische Anrufbeantworter, Sprachaufzeichnungseinrichtungen und Horverstarker*

Ddh IV 0033, *Ubertragungstechnische Vorschriften fur Gerate und Einrichtungen, die von der Post und Telegraphenverwaltung (PTV) uberlassene Stromwege oder solche des offentlichen Fernmeldenetzes benutzen*

Ddh IV 0036, *Technische Vorschriften fur dynamische Horkapseln ZB*

Ddh IV 0056, *Ubertragungstechnische Bedingunged fur Gerate und Einrichtungen, die zur Nachrichtenubertragung akustisch an Fernsprechapparate des offentlichen Fernsprechnetzes angekoppelt werden*

Ddh IV 0060, *Technische Vorschriften fur Sprechkapseln Ts*

Ddh IV 0062, *Technische Bestimmungen fur Fernsprechapparate und Freisprecheinrichtungen*

B.1.5 Technical Requirements for High Frequency Equipment

Ddh V 0023, *Fernmeldetechnische Zulassungsbedingungen fur Frankfernsteueranlagen und einrichtungen, die in industriefrequenzbereichen und im 35 MHz-Bereich betrieben werden*

Ddh V 0024, *Fernmeldetechnische Zulassungsbedingungen fur Sprechfunkanlagen und einrichtungen des festen Funkdienstes und des beweglichen Landfunkdienstes im Frequenzbereich 29,7 - 960 MHz*

Ddh V 0031, *Technische Bestimmungen fur automatische Anrufbeantworter, Sprachaufzeichnungseinrichtungen und Horverstarker*

Ddh V 0035, *Fernmeldetechnische Zulassungsbedingungen fur Personenruf und Ruckmeldefunkanlagen*

Ddh V 0036, *Fernmeldetechnische Zulassungsbedingunged fur Funkanlagen und einrichtungen zur ubertragung medizinscher Messwerte*

Ddh V 0057, *Fernmeldetechnische Zulassungsbedingunged fur Sprechfunkanlagen und einrichtungen, die auf Industrifrequenzen betrieben werden*

Ddh V 0058, *Fernmeldetechnische Zulassungsbedingunged fur Einwegsprechfunkanlagen*

Ddh V 0061, *Fernmeldetechnische Zulassungsbedingungen fur Anrufmeldeempfanger*

Ddh V 0063, *Fernmeldetechnische Zulassungsbedingungen fur Funkfernsteuerungsanlagen und einrichtungen, die nicht auf Industriefrequenzen betrieben werden*

Ddh V 0092, *Fernmeldetechnische Zulassungsbedingungen fur Sprechfunkanlagen und einrichtungen kleiner Leistung im 27 MHz-Bereich*

B.1.6 Data Transmission and Telecontrol

Ddh XI 0001, *Technische Bestimmungen fur drahtgebundene Fernwirkund Datenubertragungseinrichtungen, die an das Fernmeldenetz der PTV angeschlossen werden*

NORM A 2621, CCITT X.21.

NORM A 2625, CCITT X.25.

Ddh III 0187, *Pflichtenheft fur Anrufbeantworter*

Ddh IV 0069, *Ubertragungsbedingunged fur Nebenstellenanlagen mit digitaler Durchschaltung*

CEPT T/CD 07/01, *Teletex Terminal Equipment*

uCEPT T/CD 07/01, *Teletex Testing Procedures*

B.1.7 Addresses to Obtain National Standards

Osterreichnisches Normungsinstitut,
Box 130
1121 Wien
Austria.

B.2 BELGIUM NATIONAL REQUIREMENTS

The following documents are available in French and Dutch translations.

B.2.1 General Requirements

General requirements that the applicant for approval of a private equipment has to fulfill.

B.2.2 Technical Requirements

RN-SP 204, *Reseau telephonique automatique (PSTN)*

RN-SP 205, *Deviateurs d'appels telephoniques*

RN-SP 206, *Equipments auxiliaires speciaux (repondeurs, envoyeursautomatiques, transmetteurs de signaux)*

RN-SP 20, *Postes telephoniques sans cordon (connexion au reseau telephonique)*

RN-SP 300, *Specifications pour systems d'intercommunications a postes a boutons*

RN-SP 460, *Telecopieurs (groupes 2 et 3)*

TR, *l'arrete ministeriel du 19 octobre 1979 relatif aux radiocommunications prives*

TR, *l'arrete ministeriel du 19 fevrier 1982 modifiant et completant l'arrete ministeriel du 19 octobre 1979*

TR, *l'arrete ministeriel du 24 decembre 1982 modifiant l'arrete ministeriel du 19 octobre 1979*

TR, *l'arrete ministeriel du 10 avril 1985 completant l'arrete ministeriel du 19 octobre 1979*

TR, *l'arrete ministeriel du 12 juillet 1985 completant l'arrete ministeriel du 19 octobre 1979*

DT, *Specifications techniques relatives a l'agrement des modems de transmission de donnees*

DT, *Dispositif d'appel automatique*

DT, *Specifications techniques et criteres de commutation auxquels doit satisfaire l'appareillage prive en cas de raccordement au reseau Telex a 50 bauds*

DT, *Prescriptions particulieres relatives a la securite electrique des appareils de transmission de donnees destinees a etre connectes a des modems RTT*

DT, *Prescriptions techniques pour appareils speciaux destines a etre raccordes a des circuits d'abonnements d.u type telegraphique*

DT, *Specifications provisoires pour obtenir la "permission de se connecter au reseau DCS" pour les produits X25*

DT, *Procedure d'agrement d'un terminal Teletex*

RN-SP 208, *Specifications pour postes telephoniques*

B.2.3 Addresses to Obtain National Standards

For the standard referenced with *RN-SP*:

Regie des T.T.
Departement Reseaux Abonnes
rue des Palais, 42
1210 Bruxelles

For the standards referenced with *CT*:

Regie des T.T.
Departement de la Commutation
rue des Palais, 42
1210 Bruxelles

For the standards referenced with *TR*:

Regie des T.T.
Departement de la transmission
5e bureau
rue des Palais, 42
1210 Bruxelles

For the standards referenced with *DT*:

Regie des T.T.
Departement Transmission de donnees
Bureau DT3
Boulevard Emile Jacqmain, 164
1210 Bruxelles

For the Videotex standards:

Regie des T.T.
Departement PI
Service Videotex
Rue Carli, 4
1140 Bruxelles

B.3 DENMARK NATIONAL REQUIREMENTS

B.3.1 Requirements for Connection to Leased Lines

Danish Telecommunication Council Circular No. 12, *Subscriber Private Circuits and Terminal Equipment* (maximum data signaling rates: 1200 bits per second half duplex)

B.3.2 Requirements for Connection to PSTN

Danish Telecommunication Council Circular No. 27, *Connection of Private equipment to the Public Switched Telephone Network* (maximum data signaling rates: 1200 bits per second half duplex)

Currently, private equipment shall be permitted for one or more of the following purposes:

- Alarm transfer
- Remote monitoring
- Remote control
- Remote monitoring and control
- Telemetry
- Data transmission
- Facsimile transmission
- Telephoto transmission
- Automatic dialing
- Loudspeaking listening in
- Automatic answering

B.4 FINLAND NATIONAL REQUIREMENTS

The structural requirements for the Finnish Telephone Networks 1979 (national, in Finnish and Swedish).

Requirements for equipment connected to the public switched telephone network:

- Terminal equipment intended to be connected to the public switched telephone network (TPL 01, 4.6.2987)
- Telephones (TPL 02, 4.6.1987)
- Modems (TPL 03, 24.6.1987)
- Call charge meters of private subscribers (TPL 04, 29.7.1987)
- Cordless telephones (TPL 05, 29.6.1987)

- Telephones intended to be connected to the analogue interface of digital exchange or PBX (TPL 06, 29.6.1987)

Requirements for PBXs and telephone systems:

- Telephone systems intended to be connected to the public switched telephone network (TPL 20, 2.6.2987)
- Functional and constructional characteristics of PBX (TPL 21, 2.6.1987)
- Trunk circuit loops signaling in PBX (TPL 23, 2.6.1987)
- Analogue extension lines signaling in PBX (TPL 24, 12.6.1987)
- Digital PBXs (TPL 24, 12.6.1987)
- Digital trunk circuit interfaces of digital PBXs (TPL 25, 12.6.1987)

Requirements intended to be connected to leased circuits (TPL 30, 4.6.1987)

Requirements for equipment intended to be connected to the public telex network (TPL 40, 11.8.1987)

Requirements for equipment intended to be connected to the circuit switched public data network (TPL 50, 11.8.1987)

Requirements for equipment intended to be connected to the packet switched public data network:

- Terminal equipment intended to be connected to the packet switched public data network (Digipak) (TPL 60, 26.6.1987)
- Terminal equipment intended to be connected to the packet switched public data network (Datapak) (TPL 61, 11.8.1987)

Electrical safety requirements shall be in accordance to issue E 380.

B.5 FRANCE NATIONAL REQUIREMENTS

NFC 98 010, *Safety Standard for Telephone and Telematic Terminals*

NFC 98 030, *Safety Standard for Telephometry*

NFC 98 110, *Standard for a Recording and Answering Machine*

NFC 98 220, *Standard for a Cordless Telephone*

ST/PAA/TPA/AGH/857, *Technical Specification for Call Diverters*

ST/PAA/TPA/AGH/949, *Specification for Telephone Sets*

ST/PAA/TPA/AGH/1108, *Analogue Network Interface for Telephone and Telematic Equipment*

ST/PAA/TPA/AGH/1227, *Semi-automatic Sending of Called Numbers*

ST/PAA/TPA/AGH/1257, *Automatic Calling*

ST/PAA/TPA/AGH/1423, *Connection of Telephone and Telematic Terminals on Small PABXs—Subscribers Internal Systems*

ST/PAA/TPA/AGH/1435, *Transmission Characteristics of Telephone and Telematic Terminals*

ST/PAB/ETR/292, *Electromagnetic Compatibility of Telephone Terminals*

ST/PAB/ETR/297, *Electromagnetic Compatibility of Telematic Terminals*

ST/PAA/TPA/PRI/537, *Telephone Plugs*

ST/RTS/TDP/73, *Simultaneous Transmission of Different Modulations on Leased Lines*

ST/RTS/TDP/118, *Test Set for Leased Lines*

ST/ITD/TDP/2, *Automatic Calling and Answering on the Telex Network*

ST/RTS/TDP/11, *Group 2 Facsimile*

ST/CNR/SCG/13, *Group 3 Facsimile*

ST/PAA/TPA/AGH/39, *Asynchronous Terminals on Telegraph Leased Lines*

ST/PAA/RDS/RVA/614, *Signaling System "LO" Between PABXs*

ST/PAA/RDS/RVA/688, *Signaling System "L1" Between PABXs*

ST/PAA/RDS/RVA/689, *Signaling System "L2" Intended for Long Lines*

ST/PAA/TPA/STP/1021, *Remote Charging Receiver and Centralized Charging*

ST/PAA/TPA/STP/1065, *Switch Systems Intended for Specific Applications*

ST/PAA/TPA/STP/1022, *Private Switching System for Direct Dialing In*

ST/PAA/TPA/STP/1062, *Analogue Network Interface for Private Switching Systems*

ST/PAA/TPA/STP/1066, *Continuity and Quality of Service for Private Switching Systems*

ST/PAA/TPA/STP/1024, *Transmission Characteristics for Private Switching Systems*

ST/PAA/TPA/STP/1284, *Specifications for Tones and Spoken Announcements for PABXs*

B.5.1 Addresses to Obtain National Standards

CAITP Commission d'Agreement des Installations
Terminales Privees
Direction Generale des Telecommunications
DAII/SI
Secretariat de la CAITP
DAII/SI
7 Boulevard Romain Rolland
F-92128 Montrouge Cedex
France

B.6 FEDERAL REPUBLIC OF GERMANY NATIONAL REQUIREMENTS

B.6.1 National Telecom Requirements - DTEs

DIN 66003, *Information Processing; 7-bit Coded Character Set* (ISO 646)

DIN 66 019, *Information Processing; Basic Data Link Control Procedures for Data Communication Systems* (ISO 1745, ISO 2111, ISO 2628, ISO 2629)

DIN 66020 (Part 1), *Data Transmission; Interface Requirements for Transmission of Digital Data at Data Signaling Rates up to 20,000 Bits per Second* (CCITT-recommendation V.24 and V.28, ISO 2110)

DIN 66020 (Part 2), *List of Definitions for Interchange Circuits Between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) in Public Data Networks* (CCITT X.24)

DIN 66021 (Part 1), *Data Transmission; Interface Between Data Circuit-Terminating Equipment (DCE) and Data Terminal Equipment (DTE) on Telephone Type Circuits at 200 Bits per Second* (CCITT V.21, ISO 2110)

DIN 66021 (Part 2), *Data Transmission; Interface between Data Circuit-Terminating Equipment (DCE) and Data Terminal Equipment (DTE) on Telephone Type Circuits at 1200/600 Bits per Second* (CCITT V.23, ISO 2110)

DIN 66021 (Part 3), *Data Transmission; Interface Between Data Circuit-Terminating Equipment (DCE) and Data Terminal Equipment (DTE) on Telephone Type Circuits at 2400/1200 Bits per Second* (CCITT V.26/V.26bis, ISO 2110)

DIN 66021 (Part 4), *Data Transmission; Interface between Data Circuit-Terminating Equipment (DCE) and Data Terminal Equipment (DTE)* (CCITT V.25)

DIN 66021 (Part 5), *Data Transmission; Use on Public Data Network of DTEs Which are Designed for Interfacing to Synchronous V-series Modems* (V.28/CCITT X.21bis=V.26, V.26bis, V.27, V.27bis, V.27ter, V.29)

DIN 66021 (Part 6), *Data Transmission; V.21-compatible Interface Between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for Start Stop Transmission Services on Public Networks* (CCITT X.20bis = V.21)

DIN 66021 (Part 7), *Data Transmission; Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Synchronous Data Transmission on Telephone Type Circuits at 4800/2400 Bits per Second* (CCITT V.27/V.27bis/V.27ter, ISO 2110)

DIN 66021 (Part 8), *Data Transmission; Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Synchronous Data Transmission on Telephone Type Circuits at 9600/7200/4800 Bits per Second* (CCITT V.29/ISO 2110)

DIN 66021 (Part 9), *Data Transmission; Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Synchronous Data Transmission on Telephone Type Circuits at 48000 Bits per Second* (CCITT V.11/V.36, ISO 4902)

DIN 66021 (Part 10), *Data Transmission; Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Parallel Data Transmission on Telephone Type Circuits* (CCITT V.20/V.28)

DIN 66022 (Part 1), *Information Processing; Representation of 7-bit Coded Character Set for Serial Data Transmission* (ISO 1177)

DIN 66203, *Information Processing; Code Extension Techniques for Use with the 7-bit Coded Character Set* (complies with ISO 2022)

B.6.2 Complementary and Additional Terminal Equipment of the PSTN

DIN 41704, *Electrical Telecommunication; Plug-in Connectors for Portable Equipment, 8-pole, Normally Closed Contacts*

DIN 47100, *Cords for Telecommunications, Coding of Conductors, Colors of Outer Shears*

FTZ 386 R 1, *Connecting of Telephone Sets and Private Auxiliary Equipment to 8-pole Connection Sockets*

FTZ 11 TV 10, *Telex and Data Transmission up to 300 bit/s; Technical Characteristics of the XD-interface; Technical Specifications*

FTZ 12 MV 3, *Technical Transmission Requirements for Private Auxiliary Equipment with Electro-acoustic Coupling; Measurement Specification*

FTZ 12 R 20 (Part 1), *Telephone Subscriber Equipment; Technical Transmission Specifications for Private Auxiliary Equipment, Telecopiers and Specific Telephone Apparatus*

FTZ 12 R 20 (Part 2), *Telephone Subscriber Equipment; Technical Transmission Specifications for Directly Connected, Private Auxiliary Equipment and Telecopiers*

FTZ 12 R 21, *Measurement of Telephone Subscriber Equipment*

FTZ 18 R 1, *General Requirements of Private Equipment for Connection to Subscriber Stations of the Public Switched Telephone Network*

FTZ 18 R 2, *Requirements of Telephone Answering Machines and Announcement Machines*

FTZ 18 R 4, *Approval Conditions for Private Auxiliary Equipment; Automatic Dialing Devices*

FTZ 18 R 6, *Requirements of Automatic Equipment for Remote Announcement and Display*

FTZ 18 R 13, *Requirements for Equipment with Electro-acoustic Coupling*

FTZ 1 R 8, *Technical and Operational Conditions Governing the Leasing of Subscriber Connections, Post Office Owned Lines and Current Paths and for the Approval of Private Circuits: Guidelines*

FTZ 1 R 8-6 (Part 6), *Voice Grade Current Paths*

FTZ 1 R 8-2, *Technical Transmission Requirements for Main Station*

B.7 HONG KONG NATIONAL REQUIREMENTS

Letter On Process and Charges

Application Form for PABX Systems

Application for P/W Connection

Application for PSTN Connection

Application for Key Telephones to PSTN

Guide to Application Form for Connection to Leased Circuits

Guide to Application Form for Connection of Privately-Supplied Single Line Equipment to PSTN

Type Approval Application Modems on Private Circuits

Customer Technical Guide #1, *Safety and Electrical Protection Requirements for Private Equipment Connected to Hong Kong Telephone Company Plant*

Customer Technical Guide #1, *Safety and Power Requirements for Customer-Provided Apparatus*

Customer Technical Guide #2, *Permission to Connect Privately-Supplied Single Line Equipment to the Hong Kong PSTN*

Customer Technical Guide #3, *Connection of Customer Equipment to Leased Circuits*

Customer Technical Guide #6, *Requirements for Connection of PABX to PSTN*

Customer Technical Guide #8, *Requirements for Connection of Key Telephones to PSTN*

B.8 ITALY NATIONAL REQUIREMENTS

B.8.1 Comitato Electtrotecnico Italiano (CEI) Standards

74.1, *Safety of Electrically Energized Office Machines*

12-13, *Standard for Safety Requirements for Mains-Operated Electric and Related Apparatus for Household and Similar General Use*

103-1, *Internal Telephone Systems (PBX)*

103-5, *Telephone Sets*

103-7, *Special Telephone Sets and Auxiliary Subscriber's Devices*

B.8.2 PTT Technical Standards

Ministry Directive dated 10.4.1984, Government Official Gazette No. 166 dated 18.6.1984, *Instructions for Prevention and Elimination of Radio Disturbances Caused by Electrical Household Appliances and Similar Apparatus*

Ministry Directive dated 5.7.1983, Government Official Gazette No. 210 dated 2.8.1983, *Technical Standard on Cordless Telephones*

Ministry Directive dated 17.11.1981, Government Official Gazette No. 339 dated 10.12.1981, *Technical Standard Regarding Single Channel for Fixed and Mobile Radio-Telephone Terminal Equipment*

Ministry Directive dated 18.4.1985, Government Official Gazette No. 98 dated 26.4.1985, *Revision of the Annex to Technical Standard Regarding Single Channel for Fixed and Mobile Telephone Terminal Equipment*

Technical Standard 682 (Group 2), *Terminals for Facsimile Service*

Technical Standard 685 (Group 3), *Terminals for Facsimile Service*

Technical Standard 687, *Modems for Speechband and Baseband Data Transmission*

Technical Standard 691, *Modems for Data Transmission on Primary Group Band*

Technical Standard 694, *Teletex Terminals to be Employed on Telex and Data Networks*

Technical Standard 696, *Direct Current Signaling System for Direct Dialing in (DDI) Lines*

Technical Standard 701, *Associated Signaling System for Digital Links Between Private and Public Exchanges*

Technical Standard 697, *Videotel (Videotex) Terminals*

Technical Standard 405, *Electronic Telewriters (Telex).* This standard applies only to terminal equipment purchased by the PTT.

Unnumbered technical standard, *Deaf and Dumb Terminals*

B.8.3 SIP Technical Specifications (Complementary to and in Conformance with the PTT Standards) Applying to Terminal Equipments Purchased by SIP

Technical Specification 1083, *CCITT V23 and V24 Speechband Modems for 600 and 1200 Baud Data Transmission*

Technical Specification 1099, *Speechband Modems for Data Transmission up to 300 Baud*

Technical Specification 1137, *Speechband Modems for 1200 and 2400 Bit/s Data Transmission*

Technical Specification 1168, *Circuit Terminating Equipments (DCE)*

Technical Specification 1183, *Speechband Modem for 2400 and 4800 Bit/s Data Transmission*

Technical Specification 1197, *Land Mobile Radio Equipment for Telephone Service Operated in UHF Band*

Unnumbered technical specification (draft), *Baseband Modems for Data Transmission up to 19,2 Kbit/s*

Technical Specification for Terminals for Teleconferencing on Leased Lines and RFD (Rete Fonia Dati) (draft)

Technical Specification for Codes for Colored Video-Conferencing (draft)

B.9 JAPAN NATIONAL REGULATIONS

An example of referenced documents will be supplied with the application for approval of customer-provided equipment.

B.10 NETHERLANDS NATIONAL REQUIREMENTS

NOTE

All of the following documents are available in English except for TD 340.

TD 280-0, *General Technical Requirements for Privately Owned Equipment Connected to PTT Circuits*

TD 208-1, *Technical Requirements to be Met by All Privately Owned Equipment Connected to the Public Switched Telephone Network*

TD 280-2, *Technical Requirements to be Met by All Privately Owned Equipment Connected to Unrepeated PTT Leased Circuits*

TD 280-3, *Technical Requirements to be Met by All Privately Owned Equipment Connected to Repeated PTT Leased Circuits*

TD 280-4, *Technical Requirements to be Met by All Privately Owned Equipment Connected to Dc Leased Circuits*

TD 280-5, *Technical Requirements to be Met by Privately Owned Equipment Connected to PTT Telegraph Circuits*

TD 280-6, *Technical Requirements to be Met by All Privately Owned Equipment Connected to PTT Sound-Programmed Circuits, Operating in the 40 Hz to 15 kHz Frequency Band*

TD 280-7, *Technical Requirements to be Met by All Privately Owned Equipment Connected to Analogue Leased Broadband Data Circuits of the PTT (60 to 108 kHz Frequency Band)*

TD 332, *Technical Requirements for Connection of Teletex Equipment*

TD 333, *Requirements for Connection of Privately Owned Equipment to the Public Telex Network*

TD 334, *Specification of the Procedures for Data Exchange Between Data Terminal Equipment and Datanet I (X.25 Interface)*

TD 337, *Specification of the Procedures for Data Exchange Between Data Terminal Equipment and Datanet I (X.28 Interface)*

TD 338, *Specification of the Numbering Plan of Datanet I*

TD 340, *Requirements for Connection of Facsimile Equipment*

TD 381, *Technical Requirements for Connection of X.25 Data Terminal Equipment to Datanet I*

Htf 02-20, *Requirements for Automatic Answering Equipment Connected to the Public Switched Telephone Network*

Htf 02-124, *Requirements for the Dial Functions for Terminal Equipment Connected to the Public Switched Telephone Network*

B.10.1 Addresses to Obtain National Standards

Netherlands Postal and Telecommunications Service (PTT)
Directorate of Regulations and Special Services
Terminal Equipment Approval Section (BTR)
P.O. Box 30000
2500 GA The Hague
Netherlands

B.10.2 Netherlands Postal and Telecommunications Services (PTT)

Technical Requirements to be Met by Privately-Owned Equipment Working with Signals in the Frequency Band up to 200 kHz to be Connected to Unrepeated PTT Circuits

B.11 NORWAY NATIONAL REQUIREMENTS

B.11.1 Specifications for Subscriber Equipment

Basic Spec. A, Ed. 1-1985.11.01, *Subscriber Equipment to be Connected to the Norwegian Telecommunication Networks - Approval Procedures for Terminal Equipment*

Sectional Spec. A11, Ed. 2-1985.10.11, *Subscriber Equipment to be Connected to the Public Switched Telex Network*

Equipment Spec. A11-1, Ed. 2-1985.10.11, *Telex Unit to be Connected to the Public Switched Telex Network*

Sectional Spec. A21, Ed. 1-1985.11.01, *Subscriber Equipment with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-1, Ed. 1-1985.11.01, *Analogue Connections to the Public Switched Telephone Network (PSTN) Connection Drawings*

Equipment Spec. A21-2, Ed. 1-1985.11.01, *Telephone Sets with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-3, Ed. 1-1985.05.23, *Cordless Telephones with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-4, Ed. 1-1985.11.01, *Dialing Machines with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-5, Ed. 1-1985.11.01, *Telephone Answering Machines with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-6, Ed. 1-1985.11.01, *Recording Machines with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-7, Ed. 1-1985.11.01, *Telemetry, Remote Control and Alarm Equipment with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-8, Ed. 1-1985.11.01, *Data Modems with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-9, Ed. 1-1985.11.01, *Document Telefacsimile Equipment with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-10, Ed. 1-1985.11.01, *Acoustic Couplers with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-11, Ed. 1-1985.11.01, *Equipment Connecting a Base Station to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-12, Ed. 1-1985.11.01, *Equipment Connecting Broadcasting Equipment to the Public Switched Telephone Network (PSTN)*

Equipment Spec. A21-13, Ed. 1-1985.11.01, *Tax Meter Receivers with Analogue Connection to the Public Switched Telephone Network (PSTN)*

Sectional Spec. A31, Ed. 1-1985.10.10, *Subscriber Equipment to be Connected to the Public Circuit Switched Data Network*

Sectional Spec. A51, Ed. 1F-2-1985.02.12, *Subscriber Equipment to be Connected to Telegraph Type Leased Circuits*

Sectional Spec. A52, Ed. 1F-2-1985.10.02, *Subscriber Equipment to be Connected to Telephone Type Leased Circuits*

Equipment Spec. A52-1, Ed. 1F-2-1985.10.10, *Terminating Unit for a Base Station in Private Land Mobile Radio Networks*

Equipment Spec. A52-2, Ed. 1F-2-1985.10.10, *Operator Unit for Private Land Mobile Radio Networks*

Sectional Spec. A56, Ed. 1F-3-1985.11.01, *Requirements for the Interface Towards the Subscribers for a 1984 Kbit/s Leased Circuit*

Sectional Spec. A53, *Subscriber Equipment to be Connected to Programmed Type Leased Circuits*

Sectional Spec. A54, *Subscriber Equipment to be Connected to Wideband Leased Circuits*

Sectional Spec. A55, *Subscriber Equipment to be Connected to 64 Kbit/s Leased Circuits*

Sectional Spec. A61, *Analogue PABXs to be Connected to the Telecommunication Networks*

Sectional Spec. A62, *Digital PABXs to be Connected to the Telecommunication Networks*

General Technical Requirements to Electrical Coupled Modems-Acoustic Coupled Modems

Technical Specifications for Telephone Answering Machines Telemetry, Remote Control and Alarm Equipment, Dialing Machines, Recording Machines and Acoustic Couplers Specification, UL No. 1 - Edition 6, July 1982

Type Approval of Teletex Terminal Equipment for use in the Public Teletex Service (in Denmark, Finland or Norway), NT-Specification No. T-XXX 17-2-83

Amendments to CCITT Recommendation S.60 through S.62

Amendments to CCITT Recommendation S.70 Nov. 1982

Type Approval of Teletex Terminal Equipment for Use in the Public Teletex Service in Denmark, Finland, or Norway Common Requirements - Supplement 3

B.11.2 Addresses to Obtain National Standards

Until the new approval authority is established, these standards may be obtained from:

Norwegian Telecommunications Administration
T2
P.O. Box 6701
St. Olavs Pl.
0130 Oslo 1
Norway

B.12 SPAIN NATIONAL REQUIREMENTS

The following subheads contain technical requirements for the Spanish PTT.

B.13 SWEDEN NATIONAL REQUIREMENTS

B.13.1 General Information

General requirements for connection to the public telecommunications network:

8211-A 101 Ue, Rev D, *Provisions Concerning Privately-Owned Subscriber Equipment for Connection to the Public Telecommunications Network*

8211-A 104 Ue, Rev G, *Technical Requirements for Privately-Owned Subscriber Equipment for Connection to the Public Telecommunications Network Document List*

B.13.2 Electrical Safety

8211-A 116, 83-07-101, Rev A, *Safety Requirements for Equipment Connected to the Supply Mains as well as the Administration's Network*

B.13.3 Connection to the Telephone Network and Leased Lines - General

8211-A 112, 83-12-15, Rev B, *Technical Requirements for Connection of Subscriber Equipment to the Public Switched Telephone Network*

8211-A 113, 84-02-14, Rev B, *Technical Requirements for Connection of Equipment to Leased Telephone Circuits in the Public Telecommunications Network*

8211-A 114, 83-09-01, Rev B, *Technical Requirements for Connection of Equipment to the Public Switched Telephone Network or Leased Telephone Circuits by Means of an Acoustic Coupling*

B.13.4 Transmission of Voice

8211-A 119, 84-03-20, Rev A, *Technical Requirements for Connection of Cordless Telephone to the Public Switched Telephone Network*

8211-A 124. 85-10-02, Rev B, *Technical Requirements for Connection of Telephone Sets to the Public Switched Telephone Network*

B.13.5 Additional Equipment

8211-A 115, 85-10-21, Rev C, *Technical Requirements for Connecting an Intercept Computer to the A344 and A345 PABXs*

B.13.6 Transmission of Data, Text, and Image

B.13.6.1 Datex and Telepak

8211-A 108, 83-11-15, Rev B, *Technical Requirements for Connection of Equipment to the Swedish Datex (Circuit-Switched Public Data) Network*

8211-A 109, 83-11-15, Rev B, *Technical Requirements for Connection of Equipment to the Swedish Telepak (Packet-Switched Public Data) Network*

B.13.6.2 Telegraphy, Telex, Teletex, and Facsimile

8211-A 103, 82-06-16, Rev B, *Technical Conditions for the Connection of Private Subscriber Equipment to a Telegraph Circuit*

8211-A 120, 85-10-21, Rev C, *Technical Requirements for the Connection of Equipment to the Telex Network*

8105-A 101, 85-01-07, Rev A, *Technical Requirements for the Connection of Equipment to the Teletex Service in Sweden*

B.13.6.3 Datel (Data Transmission via the Switched Telephone Network: Connection to the Administration's Modem)

8211-A 105, 83-09-01, Rev B, *Technical Requirements for Connection to the Administration's Modems for Serial Data Transmission at Maximum 19.2 Kbit/s*

B.13.7 Sweden PTT Standards

1.0 TRANSLATION DOCUMENT 8211-A-101 (IN SWEDISH)

- 1.1 INTRODUCTION
- 1.2 DEFINITIONS
- 1.3 THE TELECOMMUNICATIONS ADMINISTRATION'S FIELDS OF PRODUCTS
- 1.4 TECHNICAL REQUIREMENTS
- 1.5 APPLICATIONS
- 1.6 CONFIDENTIALITY
- 1.7 COSTS
- 1.8 DECISION
- 1.9 APPEAL
- 1.10 THE PARTIES - THEIR RIGHTS AND OBLIGATIONS

B.13.8 Addresses to Obtain National Standards

Swedish Telecommunications Administration's Office for Approval of Privately-Owned Subscriber Equipment, Ostmarksgatan 27, S-123 42 Farsta, Sweden.

Swedish Institute for Testing and Approval of Electrical Equipment (SEMKO)
Box 1103
S-16312 Spanga-Stockholm
Sweden

B.14 SWITZERLAND NATIONAL REQUIREMENTS

Guides, recommendations, and requirements for private attachments.

B.14.1 General

PTT 693.70, *Safety Requirements for Private Attachments*

PTT 693.71, *General Requirements for Private Attachments Materials CCITT and CEPT Recommendations*

B.14.2 Telephone

BT 1-3755, *Technical Requirements for Autodialers*

PTT 839.93, *Test Report for Autodialers*

PTT 839.87, *Requirements for Answering/Recording Machines*

VL23.098, *Test Report for Answering/Recording Machines*

PTT 839.92, *Requirements for Staff Location Systems*

BT 1-3950, *Call Data Recording in PABXs*

B.14.3 Telematic

PTT 752.59, *DATEL: Data transmission Over the Public Switched Telephone Network*

BT 1-3861, *Conditions for Use of DCEs (Data Circuit Terminating Equipment, Modems)*

PTT 847.01, *Test Specification for Speechband Modems*

BT 1-3969, *Test Specification for Baseband Modems*

PTT 752.25, *Use of Acoustic Couplers*

BT 1-3967, *Test Specification for Acoustic Couplers*

PTT 752.07, *Technical Requirements for Data Attachments to the Telex Network*

BT 1-3979, *Provisional Requirements for Local Data-Over-Voice Systems*

B.14.4 Addresses to Obtain National Standards

PTT Publications:

Generaldirektion PTT
Abteilung Teilnehmer und Starkstromanlagen
Sektion Teilnehmeranlagen
Viktoriastrasse 21
CH - 3030 Bern
Switzerland.

B.15 UNITED KINGDOM NATIONAL REQUIREMENTS

Formal approval is given by the Secretary of State under the British Telecommunications Act 1984, by issuing an *Approval Order*. This defines the scope of the approval, the applicable technical documents, and any reservations or amendments. The technical requirements are given either in British Standards, BABT Special Investigation Test Schedules, BT Technical Guides, or DTI Approval Scheme Specifications.

The following are British standards involved in the attachment approval.

NOTE

BT = British Telecom

PSTN = Public Switched Telephone Network

PBX = Private Branch Exchange

*** = Not Yet Issued**

Where BS *parts* are quoted, a separate document may be purchased.

BS 415, *Specification for Safety Requirements for Mains-Operated Electronic and Related Apparatus for Household and Similar General Use*

BS 5850, *Safety of Electrically Energized Office Machines*

BS 6204, *Safety of Data Processing Equipment*

BS 6301, *Safety Requirements for Apparatus for Connection to BT Networks*

BS 6305, *General Requirements for Apparatus to be Connected to the BT PSTN*

BS 6312, *Plugs for Use with BT Line Jack Units*

BS 6317, *Simple Extension Telephones for Connection to the BT PSTN*

BS 6320, *Modems for Connection to the BT PSTN*

BS 6328, *Apparatus for Connection to BT Private Circuits*

Part 1, *Speechband Circuits*
Part 2, *Baseband Circuits*
Part 3, *Direct Current Circuits*
Part 4, *Telegraph Circuits*
Part 5, *Wideband (FDM) Circuits*
Part 6*, *Programmed Circuits*
Part 7*, *Digital Circuits for Data Rates up to 64 Kbit/s*
Part 8*, *Digital Circuits for Data Rates above 64 Kbit/s*

BS 6403, *Simplex Telex Terminal Using Single Channel Voice Frequency Signaling for Connection to BT Telex Network*

BS 6450, *Specification for Requirements for PBXs for Connection to the BT PSTN*

Part 1, *General Requirements*
Part 2, *Requirements for PBXs with Terminating Stations Treated as an Entirety*
Part 3*, *Requirements for Direct Dialing In*
Part 4*, *Requirements for Ports*
Part 5, *Facilities on PBXs*
Part 6, *Specification for PBXs Operating in Simple Call-Routing Mode (SCRM)*
Part 7, *Method for Assessment of PBXs when Observed in Service*

BS 6484, *Safety Requirements for Independent Power Supply Units*

BS 6506, *Code of Practice for Installation of PBXs*

BS 6513, *Wideband Cabled Distribution Systems*

Part 1, *Glossary of Terms*
Part 2, *Methods of Measurement*

Part 3, *Specification for Performance Requirements, Including System Safety, for Downstream TV and FM Sound Radio Signals*
Part 4, *Specification for Performance Requirements, Including System Safety, for Upstream TV*

BS 7687, *Apparatus with One or More Particular Functions for Connection to the BT PSTN*

Part 1, *General*
Part 2, *Specification for Apparatus with Loudspeaking Facilities*
Part 3, *Specification for Apparatus with Autocall Facility*
Part 4*, *Call Diversion Facility*
Part 5*, *Parallel Connected Auxiliary Apparatus*
Part 6*, *Series Connected Auxiliary Apparatus*
Part 7*, *Call Barring Facility*

NOTE

The above standards make many textual references to other BSs. Some of these draw upon requirements in IEC and ISO Specifications and in CCITT Recommendations.

B.15.1 BABT Special Investigation Test Schedules (SITS)

BABT/SITS/82/01/C, *Modems for Connection to BT Private Speechband Circuits*

BABT/SITS/83/02/B, *Power Supply Units for Use with Telecommunications Apparatus*

BABT/SITS/83/03/D, *Simple Extension Telephone Requiring Connection to an External Power Source in Addition to BT PSTN*

BABT/SITS/82/0004S/A, *Simple Extension Telephones*

BABT/SITS/82/005S/D, *Modems for Connection to the BT PSTN*

BABT/SITS/83/05/A, *Recording Machines, Answering Machines, and Answering/Recording Machines for Connection to BT Systems*

BABT/SITS/83/06/A, *Loudspeaking Telephones*

BABT/SITS/83/007S/A, *Apparatus for Connection to BT Private Direct Current Circuits*

BABT/SITS/83/07/A, *For an Extension Telephone with Secretarial Unit*

BABT/SITS/83/08/A, *Auto-Calling Apparatus*

BABT/SITS/83/09/A, *Credit Authorization Terminals*

BABT/SITS/83/10/A, *Telephones and Facility Telephones Requiring Connection to Approved PABX Systems*

BABT/SITS/84/14/A, *Modems for Connection to Approved PABX*

BABT/SITS/84/15/A, *For an Extension Telephone with Secretarial Unit for Connection to Approved PABX Systems*

BABT/SITS/85/18/A, *For the Type Approval on an Interim Basis of Hands Free Options Available with Terminal Apparatus for Use in TACS*

BABT/SITS/85/19/A, *For Changeover Apparatus Used with Private Circuits Modems Having PSTN Back-up*

BABT/SITS/85/20/A, *For Cordless Telephones*

B.15.2 DTI Approval Scheme Specifications

83/009, *Standard for Telephones Including Telephones with Additional Facilities, for Connection to Telecommunications Systems Run by BT via a PBX Approved to BT's Requirements*

84/010, *Requirements for Key Telephones for Connection to the BT PST*

84/011, *Subsidiary Connection of Approved Call Routing Apparatus to Approved PBXs*

84/012, *Technical Requirements for PBXs to be Treated as an Entirety with Terminating Systems*

85/013, *Requirements for Headsets to be Used in Association with Approved Telephones and PBX Operator's Consoles*

B.15.3 Addresses to Obtain National Standards

The various requirements documents can be obtained as follows:

BSI Sales Department
Linford Wood
Milton Keynes
England

Telephone: +44 908 32 00 66
Telex: 82577

DTI Approval Scheme Specifications may be obtained from:

OFTEL Library
Office of Telecommunications
Atlantic House
Holborn Viaduct
London
EC1N 2HQ
England

Telephone: +44 1 822 16 64
Telefax: +44 1 822 16 43
Telex: 883584

APPENDIX C

REFERENCED DOCUMENTS

C.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00002-00	*DEC STD 002-0 Ac Power Wiring, Safety Earth Grounding, Plugs and Receptacle Information and Requirements*
EL-00030-00	*DEC STD 030-0 Module Manufacturing Standard - Introduction and General Information*
EL-00053-00	*DEC STD 053-0 Interface Between Data Circuit-Terminating Equipment and the Public Switched Telephone Network (PSTN) in the U.S. and Canada*
EL-00102-00	*DEC STD 102-0 Environmental Standard for Computers and Peripherals - General Test Requirements*
EL-00119-00	*DEC STD 119-0 Digital Product Safety - Introduction and General Requirements*
EL-00119-01	*DEC STD 119-1 Digital Product Safety - Design Criteria*
EL-00119-02	*DEC STD 119-2 Digital Product Safety - Test Procedures*
EL-00119-03	*DEC STD 119-3 Digital Product Safety AS C100 Requirements*
EL-00119-05	*DEC STD 119-5 Process for Design, Evaluation, Testing, and Certification of Hardware Products to Product Safety Requirements*
EL-00122-00	*DEC STD 122-0 Ac Power Line Standard: Design Requirements and Guidelines*
EL-00178-00	*DEC STD 178-0 Digital Identification Marking Requirements - Introduction*
EL-00178-01	*DEC STD 178-1 Digital Marking Requirements for Piece Parts*
EL-00178-02	*DEC STD 178-2 Digital Marking Requirements for Subassemblies: Field Replaceable Units (FRU) and Non-Field Replaceable Units*
EL-00178-03	*DEC STD 178-3 Digital Marking Requirements for Completed Products Intended to be Sold*
EL-00178-04	*DEC STD 178-4 Container Marking Requirements for Finished Goods*
EL-00178-05	*DEC STD 178-5 Marking Symbology*
EL-00178-06	*DEC STD 178-6 Marking and Labeling Requirements for Diagnostic Tools and Diagnostic Software*
EL-00178-07	*DEC STD 178-7 Translations*
EL-00178-08	*DEC STD 178-8 General Shipping Documentation and Container Labeling Requirements for Finished Goods Intended to be Shipped to Customers*
EL-00178-09	*DEC STD 178-9 Shipping Container Marking Requirements for Goods in Process*
EL-EN210-00	*Technical Bulletin Telephone Adapter Cables*

Copies of Digital EL-Class documents may be obtained from Standards and Methods Control, NRO4/D4, DTN: 287-3724, JOKUR::SMC.

Please provide your name, mailstop, cost center, badge number, and node address when ordering.

```
+-------------------------------------------------------------------+
|                        READER COMMENTS                            |
|                                                                   |
| Your  comments  and suggestions  will help  Standards and Methods |
| Control improve their services and documents.                     |
+-------------------------------------------------------------------+
```

Did you request this document? _____ If so, did it arrive within a satisfactory period of time? _____ Please comment.

What are your impressions of this document? Consider format, organization, completeness, readability, and illustrations.

——————————— **FOLD ON THIS LINE** ———————————

Did you find technical or clerical errors in this document? If so, please specify the page number(s) and the error(s).

Are the instructions for the update package clear? _____
Was an index available? _____ If not, is one needed? _____
Do you have other suggestions for improving this document?

The following information is optional:

Name _____ Mailstop _____

Department _____ Node _____

Send your comments to JOKUR::PROJECTS, or fold, staple, and send this page through interoffice mail to:

```
+--------------------------------+
|       READERS' COMMENTS        |
| STANDARDS AND METHODS CONTROL  |
|           NRO4/D4              |
+--------------------------------+
```